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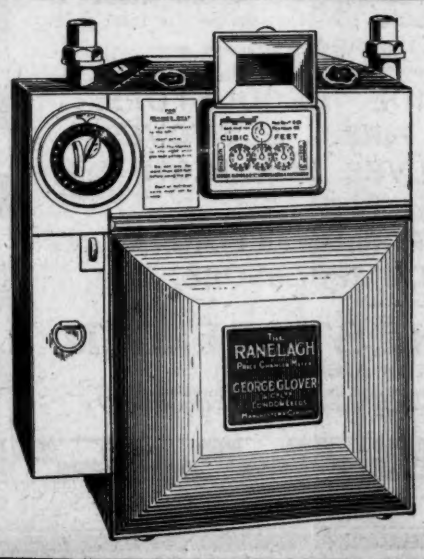

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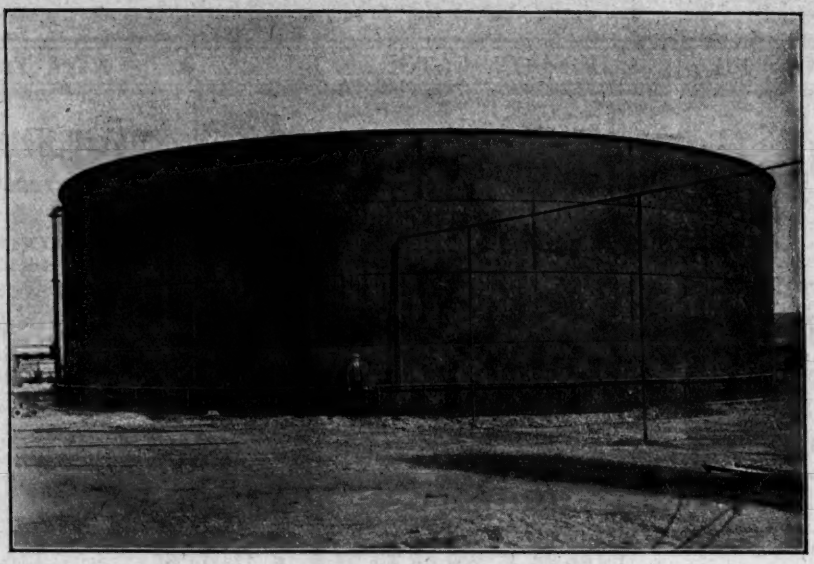

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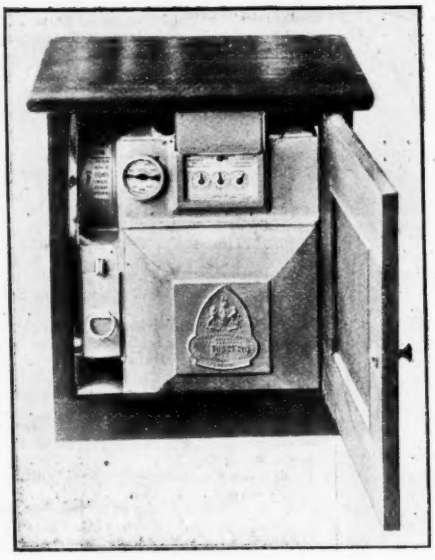

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VOL. CLX., No. 3101.] WEDNESDAY, OCTOBER 18, 1922. [74TH YEAR.

EDITORIAL NOTES.

The Specialist and Large Capacity Gasholders.

WE are greatly indebted, and our gas-engineering readers will also be, to Mr. R. J. Milbourne, Assoc.M.Inst.C.E., for an engineering contribution to our pages that is of outstanding interest and highly instructive. It is in the main a detailed description, with drawings and photographs, of the 12½ million c.ft. holder, which Messrs. C. & W. Walker have constructed for the Australian Gas Light Company at Sydney. This is the largest gasholder that Messrs. Walker have ever built; for it is the third largest holder in the world—the two that have supremacy in magnitude being the twin ones of the Consolidated Gas Company of New York, which have an individual capacity of 14 million cubic feet. The large holder at East Greenwich now takes fourth place, but only short of the storage capacity of the Sydney holder by about ½ million cubic feet. Mr. Milbourne's contribution commences this week; and an instalment of it, with drawings and other illustrations, will be given in succeeding issues until completed.

The value of the contribution is enhanced by the freedom with which Mr. Milbourne is giving the details of this mammoth structure, which is another monument to the extensive advance that structural engineering of the first order has made in the gas industry. But though this publication of detail is being made with such generosity, it does not at all follow that the information presented could be adopted for, and applied to, the construction of a gasholder of similar capacity elsewhere. In designing a holder of any considerable capacity, local circumstances, and the strains to which the structure is likely to be exposed, have to be taken into account; and these are matters for the specialist. In the design of this holder, the local conditions, and especially the winds of exceptional severity to which it will be, and is now, subjected at Sydney, were carefully considered, and the necessary calculations made. But altogether different local conditions and wind stresses and strains might obtain elsewhere. Such holders are not things that should be the subjects of design by engineers who are more or less amateurs at the work, and that on a relatively small scale. The larger the holder, the greater the capital expenditure, though not per 1000 c.ft. of capacity. But the larger the capital expenditure, the greater the depreciation of the value of the outlay, if an inefficient structure results.

In the forepart of his article, Mr. Milbourne says some sage things on the general question of gasholder building. He puts them modestly and courteously; and with him all but prejudiced gas-supply engineers will agree. Holder designing, particularly on the large scale, is distinctly a matter for those constructional engineers who are in daily touch with such work under a variety of conditions. This, of course, does not apply so much to gas undertakings where the chief is an engineer of high qualification in constructional work, and who perhaps knows his local conditions better than specialist gasholder designers and constructors could do. At the same time, such engineers are not averse to, and are wise in, having their calculations checked and corroborated, or, if need be, revised, by specialists, with still larger experience than they themselves possess, and who are *au fait* with the many loopholes there are for error in such structures. The very first words of Mr. Milbourne's article are: "There is probably no part of the plant on a "gas-works which demands such a thorough knowledge of "structural engineering as the design and construction of "the gasholder in order to obtain a substantial and eco-"nomical structure." The gas-works engineer has his attention directed more immediately to the carbonizing plant and other manufacturing processes, and for him the design and building of gasholders are of comparatively rare occurrence—unless the undertaking is making abnormal progress; and then progress nowadays generally or largely means an increase which brings about a more uniform demand throughout the twenty-four hours, and so vastly improves the position of storage capacity in relation to output. Experience, therefore, on the part of individual gas-supply engineers cannot be of an extensive order in this particular line of gas-engineering work. And as our contributor points out, although a considerable proportion of a holder structure may be calculated on a strictly scientific basis, the design of other parts is to a great extent dependent upon experience, and a careful balancing of the practical knowledge available. The tendency to build holders of larger capacity is another important consideration. But investigation has assured Mr. Milbourne that large gasholders are not infrequently designed and constructed according to the same principles as small ones, and that like errors are committed in the construction of both. But whereas these errors may be considered insignificant in the case of small holders, their importance increases with the size of the holder, and may result in dangerous strains. Therefore, the tendency being to larger holders, on all grounds—safety, economy, and efficiency—the more imperative is it that every means of assurance shall be applied to their design and construction. One of those means is the aid of the specialist with widely diversified experience in this particular line of engineering construction; and no good gas-works engineer will be prepared to argue to the contrary.

The tendency to holders of the larger capacities has been of comparatively slow growth. Mr. Milbourne does not overlook the work of the intrepid engineers who carried design into the higher realms of magnitude. He particularly instances Trewby, Livesey, and Hunt; and he mentions the lasting indebtedness of gasholder designers, builders, and users to Mr. F. S. Cripps for his investigations into the strains to which such large structures are subjected, and from which research formulæ were deduced by him to enable such strains to be calculated. In the work of gasholder building and progress, this country can claim to have taken foremost place; and to-day it has a larger number of firms who specialize in the work than any other country. All concerned in gas engineering will endorse the hope of the author that this proud position will be always maintained. It can be and will be, if advantage is taken of the considerable measure of ability and experience that we have in this direction; but it would be quite easy to lose the position by indifferent work produced by incompetence and incomplete knowledge. The collapse of even a single small holder would give a nasty shock to prestige. What would happen to reputation if from structural defect a large holder collapsed, is more than we care to contemplate. However, the pioneers in the design of the larger holders were far-seeing men; and they had an eye upon the economy that larger capacity would produce per 1000 c.ft. of storage—subject, of course, to the costs prevailing at the time of construction. The development of gas supply itself supplied a condition, too, that allowed of larger vision and the materializing of new conceptions. And so Mr. Milbourne is able to pen the words to-day that in gasholder construction the long-view means ultimately a low capital account; and he gives some definition of a "long view" in this regard when he speaks

of looking ahead, where a ready development of consumption is anticipated, some seven or ten years. Looking well ahead, and building reasonably largely, in view of the economy per 1000 c.ft. of capacity, is a matter for the gas-supply engineer, who has to be prepared now for demand emergencies that have no comparison with days gone by. We have that tremendous peak on Sundays for cooking purposes; and there are the vagaries of our climate in winter, which, with the development of gas-fire use, will with passing time accentuate more and more the flights in demand with falls of temperature. Therefore, the most economical storage for the maximum requirement is a desideratum. There is another point. The tendency in manufacturing economy under the therm system is to reduce calorific value per cubic foot; and thus the storage of therms will require a larger capacity. If the old-time gas contained 5·3 therms per 1000 c.ft., and the gas now 4·5 therms, then a greater storage in relation to volume will be necessary. From every angle of investigation of the storage problem, the same conclusion is derived—that prudence, with reasonableness applied, declares for larger holder constructions, which can be provided at a lower cost per 1000 c.ft.—of course, subject to market conditions.

Regarding the 12½ million cubic feet holder at Sydney, which is the real subject of Mr. Milbourne's serial contribution to our columns, the Company's Engineer (Mr. A. Wilson) decided in favour of a holder with guide-framing ascending to the height of the holder when fully inflated; and he was prompted to do this by the wind severities. As to the wisdom of this choice, Mr. Milbourne does not think there could be any disagreement, having regard to the conditions. It will be found as publication proceeds that of every member of the huge structure our contributor gives many details, with drawings. This frankness and liberality on the part of a firm of contractors deserve acknowledgment and our expression of appreciation. The details are determinations from an inner knowledge of site, climatic influences, and conditions of working; and therefore only those who have the necessary knowledge of them could safely indulge in criticism. But there is the structure finished and working well—thus giving every satisfaction. This being so, hearty congratulations on this new illustration of large gasholder construction may be tendered to the Australian Gas Company, their Chief Engineer (Mr. Wilson), and the contractors.

Ploughing the Sands.

In his campaign for imposing fresh restrictions on the gas industry, Professor Bone has been altogether unsuccessful. But he is persistent; and whenever opportunity offers, he writes another letter to "The Times." The communication to our morning contemporary by Sir George Beilby (noticed in the "Journal" last week) supplied another opportunity. Sir George showed how extremely well the consumers of gas are safeguarded by the provisions of the Gas Regulation Act. Apparently Prof. Bone does not agree; and so he is still clamouring for a disinterested Public Commission to overhaul the doings of the industry. The gas industry has already been investigated inside out; but Prof. Bone seems to be as bad as the Trade Unions, who, if the decisions of arbitrators do not coincide with their views, still try to make things unpleasant. This is not at all nice of him. So far as we can gather, what he still wants is that the questions of inerts, carbon monoxide, and pressures shall be again raked over, and that sulphur and cyanogen compounds shall also be brought under review. These are matters that do not concern the question of charging by the therm, which was at the base of the recent agitation, but which consumers now find (with prices receding) is a harmless sort of thing so far as charges are concerned, though beneficial in ensuring that they only pay for the quality delivered. On to the dying gas account agitation, Prof. Bone wants to hook his own little plough. He says that he thinks there is great urgency for another inquiry. We do not; and a good many other people—competent judges in these matters—are thoroughly sick of both inquiries and their advocates. The gas industry is as fully aware of its responsibilities as it is of the need of protecting its own interests by looking after those of the consumers. As fast as gas undertakings can do so, they are reducing their price per therm. The percentage of inerts in gas has been considerably lowered since better working conditions have been made possible by plant repairs and general improvement; and the therm system, wherever it is in operation, has completely done away with the temptation to over-run the exhausters. It is well known that the proportion of water gas has now descended to pre-war levels. The minimum pressure of supply is 2 in. in service-pipes not less than 2 in. in diameter. Notwithstanding, Prof. Bone says that experience of the practical results of the Gas Regulation Act has increased the urgency of the demand for a review by an impartial Committee of the operations of the industry. The inference is that the Committees who have already inquired into certain of these matters were not impartial, in Prof. Bone's eyes. We can detect neither urgency nor need for an inquiry. We rather fancy Prof. Bone must have been lately employing a high-power magnifying glass. The fact is that the majority of gas consumers are well pleased that relief in the matter of price has made excellent headway; and this is the aspect of gas supply that concerns them most. Prof. Bone now appears to be about the only man who is dissatisfied, excepting one or two editors of daily papers who have proved that they do not understand much about the question. What is the real reason for this attitude on the part of Prof. Bone? Whatever it is, it is an unprofitable thing to plough the sands; and it must be a bit uncomfortable to be doing so practically alone.

Gas Undertakings Returns.

About eighteen months have elapsed since the gas undertakings returns were last issued. We are glad to see them again, although belated; and now they only bring us up to the end of December, 1920, for the statutory company undertakings, and to March 31, 1921, for those of local authorities. But probably their preparation has hung-fire, because there was talk at one time of discontinuing their publication. Representations from the National Gas Council, however, probably had good effect, as here we have this further issue. We fancy that the idea of dropping the compilation was conceived in the cause of economy; and perhaps now it is hoped to make the returns self-supporting, for the price has gone up heavily. The cost of the statutory companies returns is now 10s. 6d. net; the previous issue was only 1s. 6d. The cost of the local authorities returns is now 7s. 6d. net; the previous issue was 9d. These statistics are, however, a mine of information regarding the position and progress of the statutory part of the industry; and the old prices were absurdly low. We hope that the sale of the returns at the increased prices will warrant the authorities preserving their existence.

Of course, the new returns refer to a period before business in gas was being done to any extent on the therm basis. The South Metropolitan Gas Company was the only undertaking that at December, 1920, had had any experience of selling by the therm, and then it only extended to three months. In the succeeding year, more concerns commenced (for periods of the year) to work under the system; but it will remain for the statistics for 1922 to show any substantial change-over for complete years from cubic feet to therms. Compared with the previous twelve months' returns, these for 1920 (with three months of 1921 for local authority undertakings) show that the number of undertakings dealt with was 827—an increase of eleven. Expenditure of new capital had by this time well set-in again, as it is seen that the capital paid-up and borrowed was £153,266,091—an increase of £3,287,655. The aggregate revenue for the year bounded up, by £17,410,886, to £83,224,983; but expenditure tried hard to "tie" this—ascending, by £16,896,211, to £76,260,581. The difference between the increased receipts and the increased expenditure was £514,675—that is to say, the revenue was higher by that amount. It was quite a good year for secondary products; and these would account for part of the additional receipts. But if we assume that the difference between the increase of receipts and the increase of expenditure—£514,675—was due wholly to gas, this sum would represent less than 10d. per 1000 c.ft. for the additional gas sold during the year; or spread over the entire gas sales, 0·51d. per 1000 c.ft. This shows that there was a close approximation between estimated revenue and expenditure.

The quantity of coal carbonized was 17,944,377 tons—an advance of 910,665 tons. The total quantity of coal gas made was 219,718,988,000 c.ft., of water gas 38,225,179,000 c.ft., and "other gas" 5,342,096,000 c.ft.—a total of 263,286,263,000 c.ft., which quantity is an increase of 13,719,849,000 c.ft. upon the previous twelve months. It

would be interesting to know what is included in "other gas." Does it mainly mean gas from complete gasification plants and coke-oven gas purchases? Not knowing precisely what it signifies, it makes manufacturing calculations rather difficult. If we take the 219,718,988,000 c.ft. of coal gas, and divide by the coal carbonized, a make of 12,244 c.ft. per ton is found. If the quantity of coal carbonized includes the raw material for the principal part of the "other gas," then we should be able to add something like 300 c.ft. to the make of 12,244 c.ft. per ton, which figure, standing alone as an average, is quite a good showing for large and small undertakings alike, with manufacturing plants in various stages of condition. The quantity of gas sold in the twelve months amounted to 241,018,701,000 c.ft. —an increase of 12,480,703,000 c.ft. upon the previous year, or 5·46 p.ct. This indicates a good general expansion of business; but when we get the whole of the undertakings on to the therm basis, and have had a couple of years' returns, there will be a better and a safer means of comparison, subject always to reduction of consumption by the progressive use of higher efficiency appliances, over which no gas man will grumble. The growth of the number of consumers during the year was highly satisfactory—95,089, making the total 7,635,222. It is noted also that the public lamps in use numbered 622,797—an improvement of 77,085 compared with the previous year. Excluding the public lamps, the sales of gas averaged per consumer 31,566 c.ft.; and in the previous year 30,309 c.ft. The mileage of mains was extended by 223, making 40,332 miles in all. Dividing the sales of gas by this figure, an average consumption per mile of main is found of 5,975,867 c.ft. Twenty years ago the number of miles of main was only 29,144, and the sales of gas 147,732,584,000 c.ft.; so that the former figure has grown by 11,188 miles, and the latter by 93,286,117,000 c.ft. This is healthy expansion. The average sale per mile of main twenty years ago was 5,069,000. Therefore, up to these newly issued returns, the average sale per mile (notwithstanding the large extension of the mileage) increased during the twenty years by 906,867 c.ft.

Many interesting comparisons could be made from the figures in the returns, not only as between year and year, but as between companies and local authorities. Enough, however, has been said to show that the year dealt with was no exception to the rule for the gas industry of an uninterrupted progress.

Calorific Values in the United States.

A GREAT change is coming over gas qualities in the United States. Time was (and it does not seem so very remote) when some of the gas undertakings there were under an obligation to supply gas of upwards of 20-candle power. Then during the war came high-priced oil of low quality; and the undertakings had to change from heavily carburetted water gas to a lower stage in enrichment. Through this, there has been a considerable reversion to coal-gas manufacture. The Public Service Commissions have also receded considerably from their aged and conservative ideas as to gas qualities. The cases that gas manufacturers were able to put up against a continuance of those high qualities, supported as they were by the experience and researches in this country as well as in the States, were too much for the Commissioners, who are now quite reasonably disposed; and so qualitative standards have been on the decline. Not long ago, in some States, succeeding change from illuminating power to calorific value, the latter was prescribed at as high as 600 B.Th.U., or thereabouts—the figure having some correspondence with the illuminating power standard which it then displaced. Of course, this was economically unsound from the points of view of both gas maker and gas user. However, matters have undergone a remarkable alteration. High calorific values have had a long slide from the eminence they formerly occupied; and upon this fact we congratulate all concerned.

In the case of New York, which should have led in the matter of renouncing illuminating power for calorific value, this has only just been done by the Public Service Commission authorizing the change, though for years the Companies have been testing the gas for calorific power. This much-belated concession, we are glad to see, comes down much nearer to current practice in this country than was the case with some of the earlier prescribed values in certain States. The transfer to the new conditions was made on Oct. 1; and the value prescribed is 537 B.Th.U. per cubic foot on the monthly average, and not less than 525 B.Th.U. on any three consecutive days. Thus this conspicuous exception, of New York not being under a calorific value standard, has at length been removed.

Baltimore is another interesting example, with special conditions; and it particularly illustrates how the old favour for high standards has been dislodged, and a more reasonable idea has been introduced. The Committee of the Public Service Commission who have been considering the matter recommend that the existing standard of 500 B.Th.U. shall be continued on a monthly average, with the existing minimum of 490 B.Th.U., and a maximum of 520 B.Th.U. The fixing of a maximum is not a novelty, though it would be in this country. Indeed, there is no real need for it, notwithstanding that a modicum of justification could be advanced, in that sudden upward extensive variations in calorific power would lead to loss of efficiency, unless there was prompt adjustment of the air supply. But such flights are not usual in normal gas-works operations. Perhaps, however, Baltimore is regarded as not altogether normal, seeing that a large proportion of the gas is purchased from coke-oven owners, and for the rest carburetted water gas is used. Here again one gets confirmation of a recession from extravagance in the matter of standards. In 1915, the Public Service Commission established a calorific standard of 600 B.Th.U. monthly average. Three years later circumstances had altered; and the standard was lowered to 550 B.Th.U. Subsequently, through exigent conditions, a reduction was made to 500 B.Th.U. As seen, at that value it is considered the standard should remain. The United States are getting more and more into company with the trend of calorific values in other countries.

The Training of the Gas Engineer.

OVER the surface of the industry's affairs, waves of attention and interest intermittently flow respecting the training of young men for the gas-engineering profession. The Presidents of the Junior Associations are just now giving renewed consideration to the matter. Last week we had Mr. George Dixon supplying some sound advice on the subject in his address to the Manchester Junior Institution. Almost simultaneously, Mr. W. A. Dearden, as President of the Scottish Junior Gas Association (Eastern District), was dilating on the same topic; and with those two addresses can be associated some of the prefatory remarks in that of Mr. W. J. Lennox to the Scottish Junior Association (Western District). Several other matters treating of various gas-works processes were dealt with in the two latter addresses. But on this particular matter of training, Mr. Lennox, looking at the variety of gas plant to-day, and at the life and activity that are being displayed on all sides, finds that never in the history of the industry has the spirit of evolution been so pronounced. But this means high qualification and a large capacity for discernment on the part of the men holding the chief executive and advisory positions in the industry; and the necessary qualifications and selective powers can only be realized by proper training. That is the one way to the highest efficiency. Mr. Lennox, however, did not discuss the course the training should take. Mr. Dearden, on the other hand, had something to say on that aspect of the subject. We are sympathetic with the lines he took, because of the men whom he had in view; though at the same time, we cannot admit that his suggestion can be regarded as anything more than a makeshift for a higher standard in training methods. Mr. Dearden admits, and all do so, that the responsibilities and the multiphased duties of a gas engineer and manager need the highest possible competence. That competence is not to be acquired without thoroughness in study, and that thoroughness cannot be secured unless proper opportunities and facilities are available. By less thorough means than the best, a student may improve himself; but he is at a disadvantage, and must be, compared with those who are more fortunate, and have the necessary ability for deriving the maximum benefit from their opportunities.

It is pointed out by Mr. Dearden that, through lack of the necessary guiding influence, one often finds students attempting to study gas manufacture without the least knowledge of chemistry and engineering. Of course, such students are wasting valuable time; and it is this waste and disadvantage which he would like modified. The students he has in mind are those who are engaged on gas-works or in the establishments of gas-plant makers, and

whose only hours for study are those that can be pressed in after the work of the day is over. Any educational scheme for gas-engineering training, he submits, should provide for this class of man. We agree with this, but must confess that we do not like Mr. Dearden's suggestion, although the confession must be extended by the admission that we have nothing better to offer that is original. The best we can do is to say that we should be glad to learn that a greater number of young gas men were seeking to acquire a larger knowledge of mathematics, physics, chemistry, and the principles of engineering at the technical schools that are to be found to-day in most cities and towns, and access to which is easy for young men from a considerable area round. That is a means for the acquisition of fundamental knowledge of which advantage is not taken by many who are by circumstances debarred from taking advantage of the courses at our universities. The suggestion Mr. Dearden makes has been inspired by the plan of instruction by correspondence; and it is that a definite course of correspondence classes and examinations should be formulated on a national basis. This, he proposes, should be the work of the Institution of Gas Engineers. He thinks that if this were done, the young men of the gas industry would no longer be at a loss as to how to proceed with their training. We recognize that this plan is for men who lack higher opportunities, but who are willing and desire to qualify for a responsible position in the industry. At the same time, we cannot avoid keeping well in view the need of the industry for a high standard of qualification; and we cannot look upon the proposal of Mr. Dearden as a sufficient substitute for systematic courses of study in contact with a competent and encouraging professor and assistants who render help when difficulties arise, and with accompanying practical experience in the college laboratory and workshops—this, of course, being but the prelude to training on the works. Such a means of training in fundamentals and that proposed by Mr. Dearden are as wide asunder as the poles. A matter for regret is that all who aspire have not the opportunity to pursue a course of training acknowledged to be the best.

The Therm System and an Inquiry.

The suggestion that there should be an inquiry into the therm system is to be taken up by the London County Council. The Public Control Committee have yielded to a certain amount of pressure, and have recommended the Council to ask the Board of Trade to institute an immediate inquiry into the question of the method of charging by the therm. They do not suggest that the complaints are more than allegations that the therm system was responsible for higher gas accounts in the June quarter. The Council themselves are large consumers; and they know how their own June quarter gas accounts stood as charged by the therm. They are also aware of the effect of price reductions on present consumption; and their officials are further cognizant of how relatively small is the increase of dividend to the stock-holders of the companies on a lowering of price compared with the aggregate sum that the reduction represents to the consumers.

Gas-Mantle Price Reductions.

The British gas-mantle makers have reduced their prices; and, as was seen in the "Journal" last week, a duty of 33⅓ p.ct. has been put upon mantles or parts of mantles the birthplace of which is Germany.

Dividends under the Therm System.

In our news columns to-day, there appears a table showing the dividends distributable by the Gas Light and Coke Company on the ordinary capital, at various prices per therm. The maximum rate of dividend is shown, then the deduction for redemption fund, and finally the net rate of distributable dividend. Of course, the standard price is subject to possible revision under the Gas Regulation Act, in which event the dividends payable as shown in the table would be modified. However, the calculations will be very serviceable not only to the proprietors, but to intending investors. Other gas companies may think it worth while to copy the Gas Light Company by circulating a similar table.

Local Authorities and Capital Subscription.

We have always held the view, and believe it to be perfectly sound, that local authorities who borrow money ought not to be allowed to speculate with it in any form of trading enterprise over which they have not complete jurisdiction. By the latest Electricity Supply Act, they are given power to do so in the case of Joint Electricity Authorities; but, worse still, similar authorization has been given to invest in the capital of the South Wales Electrical Power Distribution Company. This new extension of the powers of local authorities we consider, as a principle, perfectly indefensible. The National Gas Council, as representing a large ratepaying industry, opposed the conferring of the new power. They were unsuccessful in this; but the recently issued minutes of the Central Executive Board of the Council state that the Ministry of Health have written to say that they will be prepared to consider any representations which may be made to them by any gas-supply authorities or companies who consider that, as ratepayers, they are affected by any proposal of a local authority to subscribe to the capital of the South Wales Company.

Gas Coal Position.

The situation in regard to gas coal is very firm in the Durham and Northumberland areas, in view of the large bookings under contract, and orders from the Continent, which latter still arrive for fairly substantial quantities. This means that, for the time being, supply is about fully covered by commitments—at all events, this is the report received from the district. Quotations are being maintained at very much the same levels as during the last two or three weeks; but they are not taken to be anything more than a basis for negotiation. In the Yorkshire area, good business is being done with best screened—in fact, there is now very little of this grade on offer. The quotations for it are from 20s. to 1s. or 1s. 6d. below. There is a good supply of unscreened varieties available. For both screened and unscreened, some gas undertakings doing business with this area are asking for additional supplies. From the Lancashire and Cheshire pits, as well as from those of Nottinghamshire and Derbyshire, regular streams of gas coal in larger volume than a week or two ago are now leaving to meet the needs of winter. Colliery owners in those and other areas have expectations that demands by gas-works will almost immediately still further increase.

Imported Motor Spirit.

Motor users and manufacturers are becoming more and more insistent on a return to a tax being placed on motor spirit and removed from horsepower, as the former is considered fairer to those owners of cars who do not use them regularly at any time during the year, or very little in the winter months. Various representative motor associations have presented a memorandum to the Ministry of Transport, urging that in place of the present system of motor taxation there should be a flat rate duty per gallon on all imported motor spirit other than power alcohol, with a moderate annual registration and license tax on each vehicle. The producers of benzole would welcome the change.

Electrical Activity.

In several of the London papers at the end of last week, advertisements by the Electrical Development Association were seen. They were striking, if not large. Lines that were eye-arresting were: "Summer Time Ended," "Use Electricity for Light and Heat," and "Electricity Saves More than it Costs," which final statement remains to be proved. There were, of course, lines that were intended as a sly kick at gas and the therm—such as: "The electricity meter is marked in plain figures, and you pay for what you use." "Electricity cannot be diluted or adulterated." Then the lower charges for installation and renewals were brought out by: "British made electric lamps below pre-war price. Cheaper electrical material and appliances. Installation work and fitting at reduced cost. Lower and simpler charges for electricity." There are lower charges for gas, and the flat rates for it could not be simpler. Installation and renewal costs for gas have all been reduced through the drop in the prices of materials and labour; and the British gas-mantle makers have all announced reductions in prices.

Coal Miners' Claim for a Subsidy.

Through his many engagements, the Prime Minister has not yet been able to make an appointment for an interview with the miners' representatives, to hear their case for a subsidy owing to

the "appalling poverty" of the workers. Meantime, Mr. Frank Hodges, the Secretary of the Miners' Federation, has issued a mass of figures to prove the righteousness of their claim. But the data have been challenged by a few plain figures, which do not support Mr. Hodges. A prosperous year for the coal industry was 1913. In that year the wages bill was £91,000,000; and for six months, this would average £45,500,000. In the first six months of this year, the amount paid in wages was £65,367,526—an increase of 43 p.ct. In 1913, the average number of workers was 1,110,000; in the past six months, 1,095,000. In 1913, eight hours were being worked; now seven hours. These figures do not attest the accuracy of "appalling poverty" as a description.

PERSONAL.

Under the auspices of the Chemical Engineering Group of the Society of Chemical Industry, a dinner, followed by a presentation to Mr. H. Talbot, B.Sc., A.R.C.S., will take place next Friday, at the Hotel Cecil. The dinner is in honour of his forthcoming marriage. Particulars of the proceedings may be obtained from Mr. J. Arthur Reavell, Chairman of the Chemical Engineering Group, No. 24, Buckingham Street, Strand, W.C.2. Mr. Talbot, who was born near Leeds 37 years ago, after graduating in both chemistry and engineering with unusual distinction at the Royal College of Science, did important research work with Sir Edward Thorpe, C.B., and was later appointed Lecturer in the Imperial College of Science and Technology, which post he held for some years. About two years ago he was invited to join the Welsbach Light Company, Ltd., for whom he is now acting as General Manager. Mr. Talbot joined with Prof. Hinchley in laying the foundation of what has since developed into the Chemical Engineering Group; and he has been largely responsible for the progress of that body. He is likewise interested in the movement for the establishment of the Institution of Chemical Engineers.

NATIONAL GAS COUNCIL.

Central Executive Board.

A meeting of the Central Executive Board of the National Gas Council was held at No. 30, Grosvenor Gardens, S.W., on the 10th inst.—Mr. D. Milne Watson in the chair.

Coal.

A discussion took place with regard to the trend of the coal market, and members from different districts reported the position in their area.

Standard Gas-Cookers.

Applications for specifications, forms of tender, contract conditions, and drawings were reported to have been received from a number of representative firms.

Model Bill, 1922 (House of Lords).

The amendments to the Model Bill, 1922, as compared with the 1921 Bill, were reported.

South Wales Electrical Power Distribution Company Act.

Arising out of the Council's negotiations with the Ministry of Health on this matter, a letter was read from the Ministry stating that the Minister would be prepared to consider any representations which might be made by any gas supply authorities or companies who considered that, as ratepayers, they were affected by any proposal of a local authority to subscribe to the capital and hold ordinary or preference shares or stock in the capital of the South Wales Electrical Power Distribution Company.

Supply of Electrical Current by a Railway Company in the Area of a Statutory Gas Company.

It was reported that, since counsel's opinion was taken on this case, when the action of the railway company was pronounced to be *ultra vires*, the Electricity (Supply) Act, 1922, has been passed, by section 25 of which railway companies are enabled to supply electricity either in bulk or to any consumer, provided they obtain the consent of the Electricity Commissioners, who, before giving their consent, "shall have regard to the interests of any undertakers (other than electrical undertakers) who may be affected thereby."

The Council have written to the Electricity Commissioners with regard to the particular case under consideration, asking for an opportunity of stating their case before any such consent is given.

The "Stock Exchange Gazette" is publishing a series of very readable articles on "Gas Stocks." The first of the series appeared on Oct. 5. They are written particularly for the information of investors.

Dr. H. S. Hele-Shaw, F.R.S., will deliver his Presidential Address to the Institution of Mechanical Engineers, at 6 p.m. on Friday next, Oct. 20, in the hall of the Institution, Storey's Gate, St. James's Park, S.W.

ELECTRICITY SUPPLY MEMORANDA.

The Electricity Commissioners are not exactly a luxury to the electricity industry. They are intended to be something of great practical worth; and we believe they are so—in various directions, if not in all. But whether their greatest work which was created and planned out for them as a duty will bring to the industry all that was expected by the authors of the Electricity Supply Act of 1919, is something regarding which there may be doubt. They have to reorganize the generation of electricity in the country—co-ordinate and largely concentrate it. That is the ultimate object; and then, as the schemes develop, the country is to flow with energy, through expensive networks of mains, at a price much reduced from anything that could obtain from a mere expansion of the present systems. That is the objective. But it is all problematical, and very nebulous. However, the Electricity Commissioners and their Department have to be maintained. The Commissioners, their Department, and all the incidental expenses cost money; and the bill has to be footed. The electricity undertakings of the country are the proper sources of revenue for the purpose. But just as we anticipated would be the case, there are administrators of electricity undertakings who do not want to contribute. They regard the Electricity Commissioners and all that their work entails as redundant. But there is the Act containing the decree of Parliament—that the supply undertakings constituting the industry shall pay. The time has come for payment to be made, and for beginning the liquidation of the money that has been spent during the years 1920 and 1921. The money so far expended has to be repaid with interest in three instalments; so that the first instalment now becomes due with the account of the proportion (for each undertaking) of the estimated outgoings for 1922. The new liability has come as a shock to some of the unobservant administrators of certain undertakings; and they are paying "under protest." But this display of antagonism will have no good effect; protest of the heaviest possible weight will not avail. They may as well pay with smiling faces their present contribution at the rate of £11 6s. 4d. per million units generated, and look as pleasant as they can over it. It has to be done; and there is an end of it. The basis next year is to be on units sold—not generated. And this will be fairer to those concerns with large leakage accounts.

Paying the Piper.

Sir Harry Renwick, K.B.E., is a prophet who has honour in his own country. He has honour because he has said something much to the liking of his electrical friends. He was addressing the Provincial Electric Supply Committee of the United Kingdom, when he wound-up his interesting address by saying: "I am a firm believer in the future of the electric supply industry of this country. The demand for electrical energy in the future for all purposes promises, in my opinion, to be on an enormous scale, the extent of which very few of us are able to estimate to-day. The golden age of electricity is not far distant." This pronouncement of belief and opinion may all come true. Nobody can tell. But after all it is only a belief and an opinion from one of the human species who is no more able to foretell what is going to happen than many other intelligent people. But the belief and opinion of Sir Harry has quite excited a writer in "Electrical Industries," so much so that he has printed the message in large type; and, did the exigencies of the Press permit, he would have printed it in letters of gold. The sale of the paper would have temporarily ascended. This writer also has a belief. It is that, if every electrical manufacturer, station engineer, factor, contractor, salesman, committee member, and company director were seized with the conviction so forcibly expressed by Sir Harry, the whole outlook for the industry would be transformed. We have not the slightest doubt that the electricity industry will progress; but the "enormous scale" and the "golden age" are of those phrase polishings that attract the eye, but have no particularly solid value. However, the writer in our contemporary maintains that Sir Harry did no more than state the conclusion to which a competent survey of the situation must lead. A competent survey covers a host of factors; and as every electrician knows, some of them are not favourable to the electricity supply industry.

The Golden Age of Electricity.

For all electrical heating purposes, low tariffs have to be the rule. Of course, they must be low, in order to give electricity any claim to a place in the heating field in competition with other agents. An article in the recent special number of the "Electrician" is on "Hot Water by Electrical Methods." The first words are: "The great unsolved problem in the field of domestic electricity is water heating." That is a confession, because several makers of electric water-heating appliances claim to have solved the problem—in fact, in the same article the "Genii" heater is mentioned as a solution. But it has its limitations and shortcomings, and would torment almost to death householders who want hot water quickly. However, the writer of the article does not think the problem is unsolvable, having regard to the progress that has been made. But the sum and substance of all the progress is small, considering the time that it has been in the

Water Heating.

making. It is asserted that present experience shows that a small bath requires about 20 gallons of water at 110°, each lavatory draw-off needs about 1½ to 2 gallons of water per hour in use at 110°, and the scullery draw-off claims 2 or 3 gallons per hour in use at 160°. Actually in practice, hot-water requirements are intermittent, and the quantities very irregular. The writer says there are, therefore, two problems—one the provision of a large amount of tepid water, which must be constantly available; the other the provision of a small amount of boiling water occasionally. This latter is airily dismissed. The problem has been "adequately solved" by the various self-contained kettles on the market—expensive and unreliable as they are. The "solution" of the other problem rests on two factors—heat storage and night rates. It is submitted that an ideal combination (there is, electrically speaking, nothing new in the submission) would be a low-wattage heater for continuous running to take care of the average normal demands of each draw-off; and for emergency, the addition of 2, 4, or 6 kw. heaters in the same tank. The low-wattage heater could be sealed up for continuous running at specially low rates for electricity; the high wattage emergency heater being taken off the ordinary power rate for those districts not having a flat rate for lighting, heating, and cooking. The "Genii" system of water heating is quoted as illustrative of the lines on which the problem might be attacked. One of these heaters can be installed just where a hot water supply is required. It is simply a tank fitted with a loose cover; and these tanks are supplied in various sizes to give any desired hot water capacity. Each size is also available with different wattage immersion heaters, so that any required quantity of hot water can be obtained. It is usual to load these heaters lightly, and keep the current flowing continuously, or at "off-peak" times during the day or night. To supply hot water at a faster rate for emergency, a three-heat immersion heater and switch can be fitted. This heater is not going to solve the problem of hot-water supply by electricity to such an extent that it will be generally adopted—which is a safe prediction.

The "Inducer" Heater for Boiling-Plates.

We know well of the low efficiency of heating liquids by the use of electric elements on the hotplates. Even at the beginning of their careers, these heating elements cannot claim to have a high efficiency; and their deterioration in efficiency is something of which very little is heard. The Falkirk Iron Company have set out to alter this condition of things; and they declare they have succeeded. Whether they have or not, we cannot say. There is nothing to enable one to form judgment beyond the *ipse dixit* of the manufacturers themselves. But anyway the Falkirk Company believe that what they have done will revolutionize electric cooking. The chief feature is described as inducing heat in the bottoms and sides of the cooking utensils themselves, and not in the appliance, which remains cool. The utensils are specially made, which (we suppose) means that they are somewhat costly. There has been a demonstration of two of the new "inducers" mounted on a standard cooker—one being a large, and one a small, inducer. These appliances replaced the ordinary solid or radiant type boiling-plates. But there is a tall claim respecting efficiency. This, it is said, varies between 85 and 90 p.ct. One pint of cold water, it is asserted, can be brought to boiling-point in a minute, and 16 pints can be boiled on a consumption of 1 unit. This means an efficiency of nearly 96 p.ct. with the water at an inlet temperature of 48°; and even 1 p.ct. more than this is claimed. The lowest loading of the smallest inducer is 120 watts. We have not seen one of these wonder-producing heat economizers, and so at present cannot say more about them. But long experience shows that it is just as well to let new things of the kind have a run before accepting fully, with simple faith, the reports as to their extraordinary virtues.

High Claims.

We are getting some high claims made for water heating by electricity. This is seen above. There is also the "Colebrook" water-heater, which is being marketed by Messrs. Durant, Radford, & Co. This is a continuous flow water-heater; and it is said that it will deliver water immediately, at any temperature required from tepid to boiling. An efficiency of 94 p.ct. is claimed for it. It is made in three standard sizes. Loaded with 2 kw., and with inlet water at 60° Fahr. (which is high as an average), it is claimed that it will raise to 127° Fahr. 10 gallons per hour. This we make out to be a claim for close upon 98 p.ct. efficiency! That is by the smallest size. The second size is loaded at 4 kw., and will deliver water at 110° Fahr. at the rate of 25 gallons per hour. The largest size is loaded normally at 7·3 kw.; and it is said to be capable of delivering water at the rate of 54 gallons per hour raised to 116° Fahr., on a loading of 8·85 kw. At a 1d. or 2d. per unit, this would not be cheap. These claims to efficiencies, which practically exclude all loss, are highly interesting.

The Danger of Percentages.

When they stand alone, there is always a danger in percentages. To judge adequately their value, one wants to know the figure upon which they are based, so as to be in a position to arrive more precisely at the quantitative value. There have been in the electrical papers some laudatory references to the successes of the Hackney Borough Council electricity undertaking. A "free" wiring system has been adopted, and there has been an exhibition in the district. To this policy has been ascribed the credit of an increase of 15·66 p.ct. in the electricity supplied for domestic purposes, which, it is said, compensated for a decrease of 9·38 p.ct. in the power load. Of course, the 15·66 p.ct. for domestic purposes is a larger figure than the 9·38 p.ct. for power purposes. But what does it represent in quantity? You cannot tell the values of these percentages without knowledge as to the basic figures to which they refer. In the number of units, 15·66 p.ct. increase is much less on 500,000 units than a decrease of 9·38 p.ct. on 1,000,000.

Electric Iron Danger.

Electric irons are, according to those who sell them, among the safest things on earth. But shocks, burnings, and other happenings have made many users somewhat sceptical as to the veracity of the sellers. A much favoured trouble with them is, after use, leaving "on" the current, with the result that the iron becomes heated, and if left long enough red-hot. It starts burning its way through whatever it may be resting upon, if combustible, and perhaps this causes a big fire. There was a fire the other morning at a house in Southwick Crescent, Hyde Park, and it began in a room below others in which children and servants were asleep. Fortunately they were saved; but the damage to the property is estimated at £4000. The report before us states that the fire is attributed to an electric-iron, which, becoming overheated and red-hot, set the floor alight.

The Ideal Cooker.

There are users of electric-cookers who would wish they could subscribe from their experiences to all that Mr. A. F. Berry, of "Tricity" fame, says in the "Electrician" about the progress of the electric-cooker. Mr. Berry is an enthusiast of the first water. He has cookers to sell; and probably he has, through his agents, done more to try to beat-up public interest than any other maker. The progress that has been made in electric-cooker design has been startlingly great. That is Mr. Berry's view. But if we understand him correctly, it has not been so "startlingly great" that it has succeeded in striking "eminent electrical engineers" very forcibly. He says that "many eminent electrical engineers find it difficult to appreciate how considerable the progress of electric-cookery design has been in recent years." That being so, those electrical engineers deserve to lose their eminence, because, if Mr. Berry is right, they must be much behind the times. They must be very casual observers, and certainly not users of the particular cookers that the writer of the article has in mind. This must be so, as we are told that "to casual observers the cookers themselves, hot-plates, &c., appear to have undergone little change—in fact, in exteriors there is but little change." There is reminder in the article of the demonstrations of electric cooking that were made at the Crystal Palace in 1892. Thirty years ago! In three decades, it would have been remarkable if there had not been some progress in design; but the progress that the electricity supply industry ardently desires to see is in adoption, and this has been supremely thin. Mr. Berry seems to place in the forefront the reliability of electric-cookers. He asserts that "a young man can to-day purchase and use daily an electric-oven which will in all probability be in use on his dying day, without in the meantime requiring one penny piece to be spent on its upkeep." We are sorry for that young man, his relatives, and, if insured, the insurance company. The heating elements in an electric-cooker will not, we are satisfied, last half-a-century. Not only has the oven developed, but the hotplates of even a few years ago, it is said, have been put into the shade. Then it seems that the current consumed has been halved, seeing that, in the modern type of cooker, the daily bill may easily be of the order of 6d. a day, against the old-time cost of 1s., with current at (say) 1d. per unit. In most places, current for cooking is now more than 1d. per unit. One other point. Notwithstanding all this progress, we have Mr. Berry advocating an electric-kettle. "If," he says, "it is remembered that the efficiency of the open type element, a closed hotplate, and an electric-kettle are of the order of 40, 60, and 90 p.ct. respectively, the economical effect of supplying an electric-kettle with every cooker is made clear." This 40 and 60 p.ct. may be true temporarily, while the elements are new; but they are not lasting efficiencies; and every young man who purchases an electric-cooker will find this out before he dies. And regarding that 40 and 60 p.ct., a unit of electricity is only equal to a potential heating value of 3420 B.Th.U.

Wales and Monmouthshire District Institution.—A meeting of the Institution will be held in the Lower Police Court, Porth, Rhondda, on Wednesday, Oct. 25, when the chair will be taken by the President, Mr. James Robb, of Chepstow. The new President, Mr. Octavius Thomas, of Pentre, will deliver his address, Mr. Walter Hole, for the Institution of Gas Engineers, will explain the scheme for the future education and examination of those engaged in the technical work of the gas industry; and Mr. John Mogford, of Briton Ferry, will read a paper on "Gas Supply in South Wales: Its Past and Prospects." There will be luncheon at the Porth Hotel, on the invitation of the President-Elect, and subsequently an inspection of the Miners' Rescue Station and the Ystrad Gas-Works.

DESIGN AND CONSTRUCTION OF A 12½-MILLION GASHOLDER.

By R. J. Milbourne, Assoc.M.Inst.C.E., F.C.S.

There is probably no part of the plant on a gas-works which demands such a thorough knowledge of structural engineering as the design and construction of the gasholder, in order to obtain a substantial and economical structure.

The strains on a considerable portion of the structure may be calculated on a strictly scientific basis; but the design of other parts is to a great extent dependent on experience and the careful balancing of the practical knowledge available. Investigations made by the writer have proved that large gasholders are not infrequently designed and constructed according to the same principles as small ones, and the same errors committed in the construction of both. But whereas these errors may be considered insignificant in the case of small gasholders, their importance increases with the size, and may result in dangerous strains.

In designing a gasholder, nothing can take the place of experience gained through constant practice in the construction and erection of large ones. This experience can only be acquired by actual engagement in the details of construction and manufacture in the works of those who design and build them.

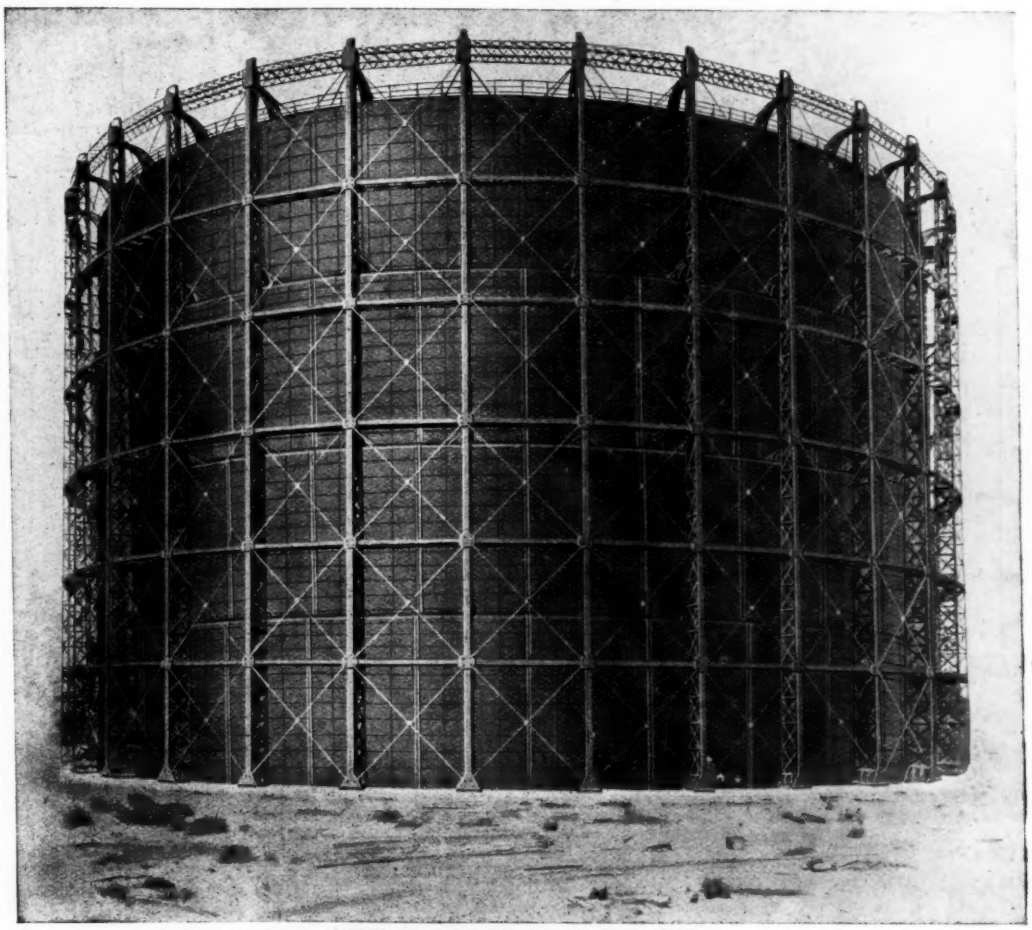
From the very beginning of the gas industry a hundred years ago, the guide-framing and holders have been constructed almost exclusively of iron and steel, although on one or two Continental gas-works holders may be seen with brick piers in place of cast-iron columns or steel standards. It is, however, scarcely imaginable that any known material other than wrought iron or steel can be used for the gasholder bell.

The year 1870 may be regarded as the commencement of a new era in the development of the gasholder, as from this date such structures were considered to be entitled to the highest consideration of the most eminent engineers and mathematicians of the day. The gas engineering profession is indebted to Mr. F. S. Cripps for the exhaustive manner in which he examined the principles upon which gasholders with guide-framing should be designed and constructed. In the book which Mr. Cripps published on "The Guide Framing of Gasholders," he investigated the strains to which such structures are subjected, and therefrom deduced formulæ to enable the strains to be calculated.

British enterprise has long led the way in the erection of large gasholders. One of these vessels, having a capacity of 8 million c.ft., designed by the late Mr. G. C. Trewby, was erected at the Beckton Gas-Works 30 years ago. The late Sir George Livesey was also a pioneer in the construction of very large gasholders. In 1880, he erected what was then the largest holder in the world (5½ million c.ft. capacity). This holder introduced an entirely new principle of construction—viz., the lashing together of the standards by struts and ties of such strength as to make the guide-framing into one cylindrical cantilever, instead of what was before a group of practically independent posts.

Mr. Charles Hunt followed (in 1887) with two still larger gasholders at Birmingham, each containing about 6¼ million c.ft. Sir George Livesey (in 1888) erected the first of his large holders at East Greenwich, containing about 8½ million c.ft.

A still larger gasholder with six lifts to contain 12 million c.ft. was erected at East Greenwich in 1892 to the designs of the late Sir George Livesey, who submitted the drawings to Mr. F. S. Cripps for his criticism and advice. For some years this holder was by far the largest in the world; but America can now boast of two, each having a capacity of about 14 million c.ft. With this exception, the gasholder described in this article is the largest that has ever been erected outside England.



VIEW OF HOLDER FULLY INFLATED.

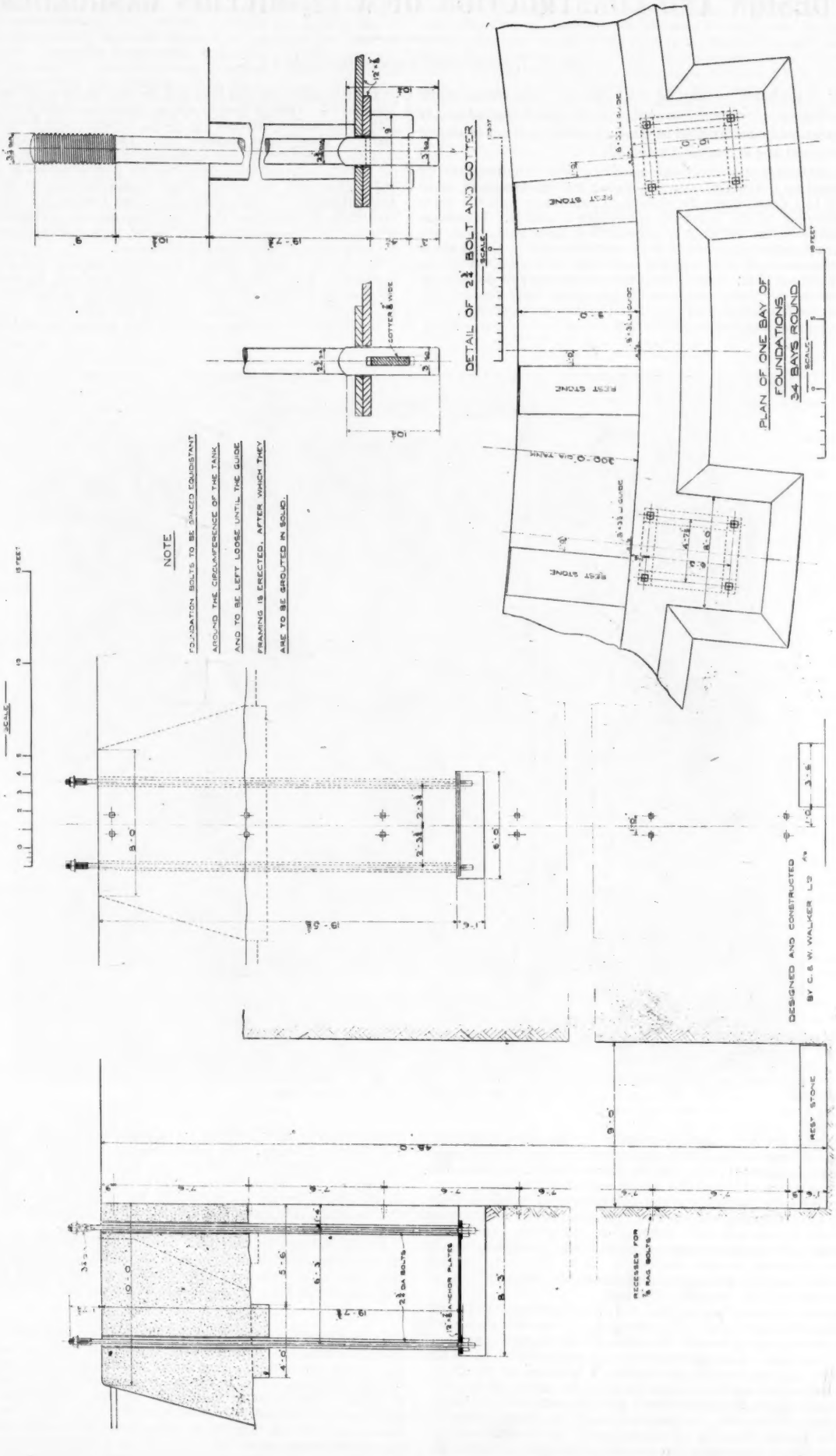
It is interesting to note that Great Britain has at the present time a larger number of firms who specialize in gasholder design and construction than any other nation in the world; and it is hoped that this proud position will be maintained in the future.

Types of Gasholders.

In deciding upon the type of holder which will best combine efficiency with economy, there are three main types of construction to be considered. The oldest of these, and the most frequently adopted, is that in which the guide-framing is erected to a height about equal to that of the floating holder when all the lifts are fully inflated. Another type is that in which the guide-framing is reduced, thus allowing the inner lift to rise above the top tier of girders when fully inflated; and the third type is that in which no such guide-framing is required. The last-named type

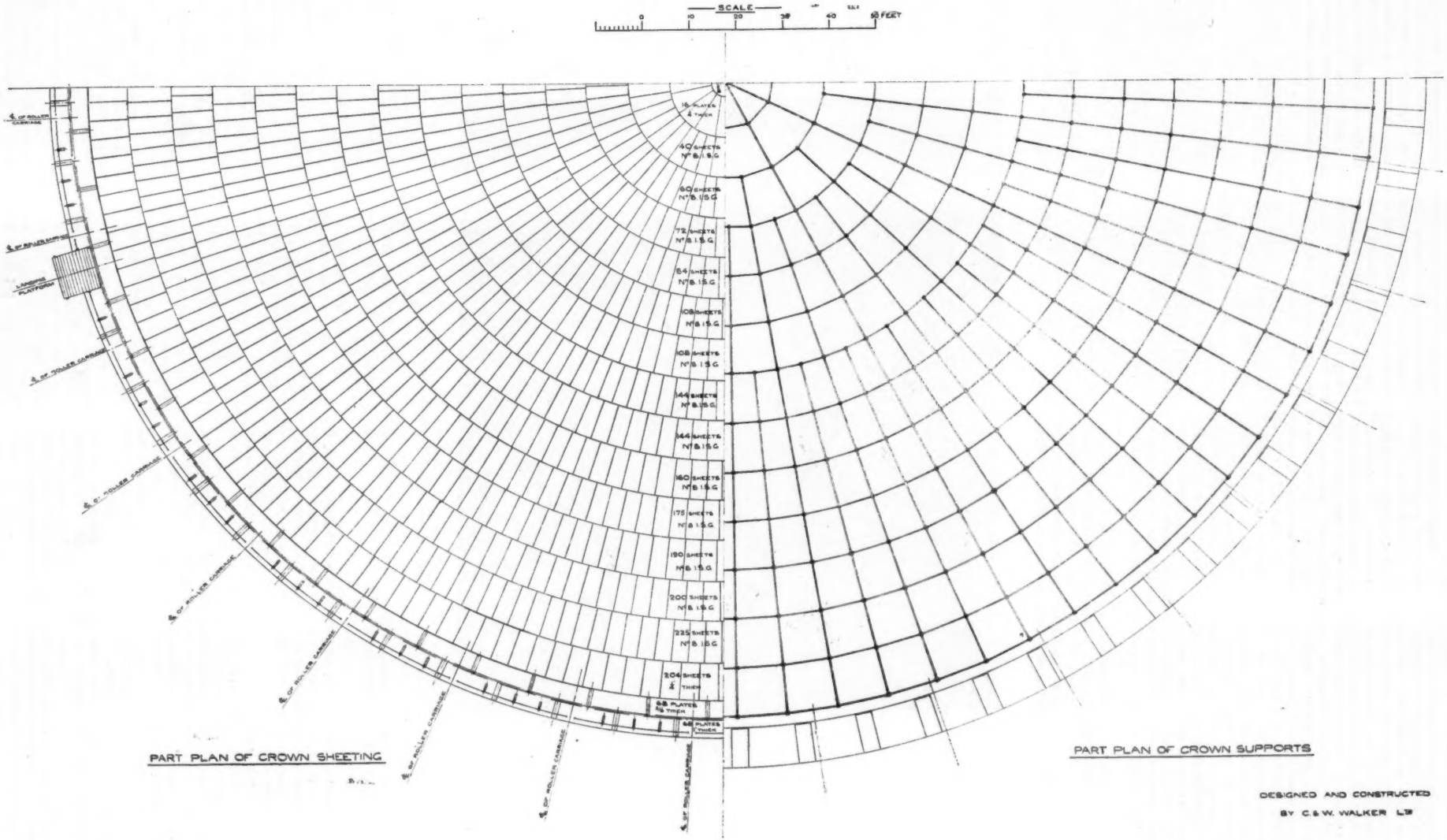
GASHOLDER—12½-MILLION CUBIC FEET CAPACITY.

[See pp. 159, 162-3.]


DETAIL OF 2½ BOLT AND COTTER
PLAN OF ONE BAY OF FOUNDATIONS 34 BAYS ROUND
NOTE
FOUNDATION BOLTS TO BE SPACED EQUIDISTANT AROUND THE CIRCUMFERENCE OF THE TANK AND TO BE LEFT LOOSE UNTIL THE GUIDE FRAMING IS ERECTED, AFTER WHICH THEY ARE TO BE GROUTED IN SOLID.
DESIGNED AND CONSTRUCTED BY C. & W. WALKER LTD
REST STONE
RECESSES FOR 1½ RAG BOLTS
ANCHOR PLATES

GASHOLDER—12½-MILLION CUBIC FEET CAPACITY.

[*See pp.* 159, 162–3.]



is now well known as the spiral-guided holder, in which the guiding and resistance to strains from wind pressure and other sources are taken-up by an ingenious arrangement of guide-rollers fixed to the top of the tank and on the dips of the holder.

If cheapness were the only consideration, it would be found that the spiral holder has always the strongest claims. With reduced guide-framing, the slight saving in first cost is seldom commensurate with the disadvantages which necessarily accompany this particular type of construction. Apparently a saving of material is effected by the reduced length of standards and the omission of one or more tiers of girders and diagonal bracing; but as the shortened standard and top tier of girders must obviously be of greater sectional area than when the guide-framing is carried the total height of the fully-inflated holder, the saving in weight of material is not so much as would appear to be effected by a casual glance at the design. In the writer's experience, this form of construction considerably increases the wear and tear on the guide-rollers, carriages, cups, and dips of the flying lift or lifts; also the rollers and carriages require much more frequent adjustment, repairs, and attention, to ensure their working properly, than with holders having the guide-framing carried to the full height.

The invitation to submit designs and quotations for the gasholder here described, however, called for a holder with guide-framing up to the full height of the holder when fully inflated. Considering the exceptional dimensions of this particular holder and the high winds prevailing in Sydney, the writer does not think there can be any question of the wisdom of the Gas Company's Engineer in selecting a guide-framed holder.

STORAGE CAPACITY REQUIRED.

For economical working, the storage capacity of a gas-works is generally stated to be not less than the maximum daily make. When considering the provision of additional storage, it is usual to make the capacity of a new gasholder at least equal to the maximum daily send-out. This was the old rule, but it has been somewhat modified by reason of the more uniform output of gas during the 24 hours, due to the use of gas for heating, cooking, and power, and also by the facility with which water gas can now be produced. The writer would say that when erecting a new gasholder, it should not be less than sufficient to bring-up the storage to from 50 to 75 p.ct. more than the present maximum of daily output, taking into account the existing storage. But much depends upon the growth of the Company's business. Some towns might take over a century to double the output; whereas ten years may suffice for others. Where a rapid development of consumption is probable, the capacity of the new holder should be determined by consideration of the anticipated daily make seven or ten years ahead. This is conducive to economy, as the cost of storage per 1000 c.ft. falls rapidly as the size of the holder increases. In gasholder construction especially, a long view means ultimately a low capital account.

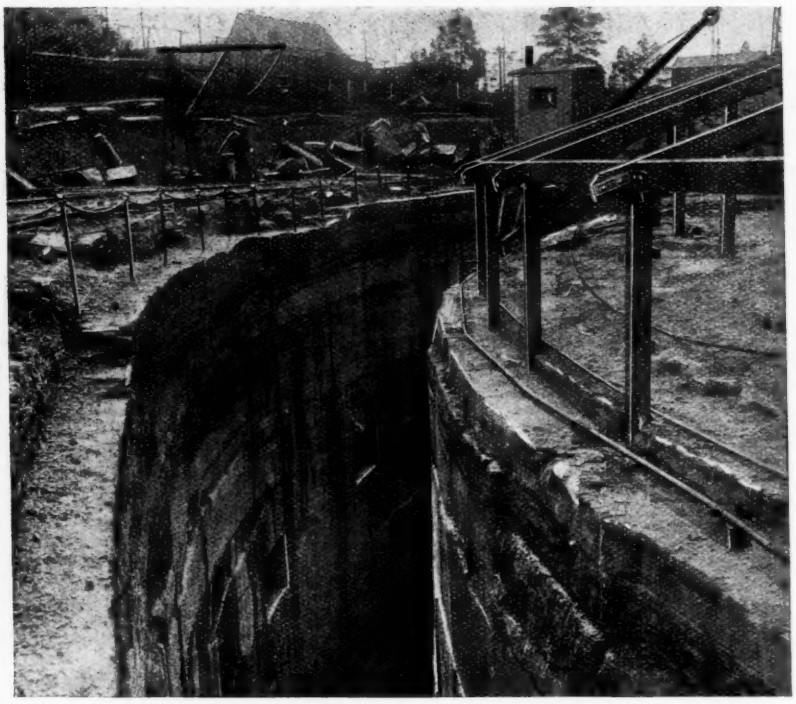
COMPARING DESIGNS AND COSTS.

With present prices of raw materials, and rates of pay for both skilled and unskilled workmen, it is not possible to compare the cost per 1000 c.ft. capacity of gasholders erected to-day with the figures of pre-war days, without making considerable allowance for the altered conditions. Moreover, comparisons of cost cannot be considered satisfactory unless due regard is given both to the design and the weight of the structure, as well as other qualifying factors. But it would not be safe to say that the cost should vary as the weight, irrespective of design. A badly designed holder may be made unnecessarily heavy without giving strength where it is required; in fact, an excess of weight may be dangerous instead of adding strength, if the material is not placed where it is needed. Owing to this excessive weight, a badly designed holder may cost less per ton of material employed than a properly designed structure, although the lighter holder may easily be the stronger one.

GENERAL DESCRIPTION.

The gasholder which is here described is one of the largest in actual working capacity of any in the British Empire. Its total capacity when cupped is 12½ million c.ft. The contract for the holder and guide-framing was placed in May, 1913, by Messrs. W. Coward & Co., Ltd., of No. 22, Buckingham Gate, Westminster, S.W., on behalf of the Australian Gas Light Company, Sydney, N.S.W., with Messrs. C. & W. Walker, Ltd., Midland Iron Works, Donnington, near Newport, Salop.

Several important points had to be borne prominently in mind in designing the holder. The cost of freight was a very serious item; and it was therefore imperative that the weight of the guide-framing and floating holder should not be greater than necessary, consistent with the strength and durability of the structure.



VIEW SHOWING ANNULAR TANK CUT IN ROCK.

As much of the work as possible was riveted-up complete before leaving the makers' works, in order to reduce the difficulty and labour of erection. The size and shape of the various pieces were carefully considered in order to conform to shipping requirements, ordinary standard sections being used throughout.

The stresses in the floating holder, top curb, and in the various members of the guide-framing were ascertained and determined from the formulæ of Mr. F. S. Cripps, Assoc.M.Inst.C.E., and the sizes of the various parts of the structure fixed.

The greatest care was observed in the manufacture of the work, to ensure that the conditions assumed in calculating the stresses were actually realized in construction.

The first consignment of the steelwork left the Contractors' works at Donnington on Sept. 27, 1913, and the last on Dec. 1, 1915—16 months after the declaration of war with the Central Powers. The long period over which the shipment was spread was due to repeated delays beyond the manufacturers' control, attributable to enlistment of workmen, difficulties of transport, and the prior claim of the Ministry of Munitions and the Admiralty for munitions of war.

On March 12, 1917, the holder was inflated, finally tested for tightness, &c.; and on completion of the test, it was put into commission. It is pleasing to the designers and makers to know that the holder is continuing to give every satisfaction.

The services of a competent and experienced supervising engi-

neer and two highly-skilled gasholder erectors were provided by Messrs. C. & W. Walker, Ltd. The remainder of the labour, skilled and unskilled, was provided by the Australian Gas Light Company's Chief Engineer, Mr. A. Wilson, who was responsible for the complete erection of the holder and framing, and carried out the entire work with commendable skill and ability.

The construction of the tank, consisting of an annular ring in the ground, also the permanent timber framing to support the crown when the inner lift is landed, were successfully carried out under Mr. Wilson's direction.

SITE.

The holder is erected at the Mortlake station of the Australian Gas Light Company, on a site adjacent to and south of the No. 1 gasholder, whose tank top stands 15 ft. above the level of that of the holder here described. The ground slopes gently approximately from north-west to south-east. At about 7 ft. below the surface of the ground solid rock was found; and it is in this that the annular ring forming the tank is shown. To level the site, soil from the north-west of the area and rock from the tank were removed to the south-east, where the upper portion of the tank side is formed of concrete and the lower portion of virgin rock; whereas on the side where the rock is highest, rock alone forms the tank side, the concrete wall increasing in depth as the surface of the rock recedes from the level of the tank top, and being at a maximum at approximately south-east. The concrete wall is keyed into the rock.

(To be continued.)

CANADIAN GAS ASSOCIATION MEETING.

The City of Hamilton was the place selected for the fifteenth annual convention of the Canadian Gas Association, which was held last August, under the presidency of Mr. C. S. Bagg.

The Executive Committee expressed deep regret at the death of Mr. John West. A letter had been received from Mr. Fred. J. West acknowledging the Association's expression of sympathy, and the Committee recommended that this be included in the minutes of the Association. The Secretary-Treasurer (Mr. G. W. Allen) stated that, owing to his acceptance of another post apart from the gas industry, he wished to resign his position with the Association. The Committee were very sorry to lose Mr. Allen, who had worked so well for the industry, and in accepting his resignation extended to him every good wish for success in his new sphere.

Mr. Bagg, in his Presidential Address, said it was hoped that all the gas companies in Canada would maintain a calorific standard reasonably above the minimum of 450 B.Th.U. required by the Government. Taking all things into consideration, it was thought fair to ask the companies to maintain a standard of from 480 to 490 B.Th.U., as being a sufficient margin above the minimum, and a figure which the Committee of the Association believed would be good operating practice. He went on to remark that some English companies on the therm basis had endeavoured to run at too low a standard, and had lately requested to be allowed to increase the calorific standard to 480 to 500 B.Th.U., which appeared to be a good working point for all general purposes. Another matter touched upon by him was service, which, he declared, must be continuous. The coal user might be unable to obtain fuel for either domestic or industrial purposes, but he expected that no shortage should exist in his gas supply. Public opinion should be gradually educated to a point where closer co-operation between manufacturer and user would tend to remove many of the misunderstandings that sometimes arose. Every member of a gas company had a duty to perform in endeavouring to so train the public mind that in days of stress, such as came from time to time, a feeling of mutual co-operation and forbearance might exist between the company and their patrons, so that the difficult period might be bridged in a spirit of friendliness and understanding which would lighten the burden, not alone of the general public, but of the gas manufacturer as well.

PRODUCTION OF OXYGEN.

A paper was contributed by Mr. Floyd W. Parsons on the future of the gas industry, in which the author remarked that the cost of producing oxygen has been reduced from 20 c. per c.ft. in 1906 to 1 c. at present; and yet we have hardly commenced to produce and use oxygen as we should in our industrial life. One blast-furnace, turning out 500 tons of iron a day, requires five times as much oxygen in its operation each 24 hours as is produced daily by all the plants in North America. Before long, one or more of our great steel companies will decide that the time has come to manufacture cheap oxygen, and the necessary funds will be forthcoming for the development and perfecting of present crude practices. Then, instead of 1 c. a foot, oxygen will be available at a cost of $2 or $3 a ton. When that moment arrives, our metallurgical, chemical, and all other fuel-consuming industries, especially the gas industry, will be completely transformed. Both here and in Europe gas men are sceptical concerning the advantages to be derived from the use of oxygen in gas manufacture; but I am unable to share such doubts. The production of oxygen at $10 per 1000 c.ft. is of small interest to us, but the production of this element at a cost of 5 c., or even 10. c. per 1000 c.ft. is quite a different matter. Such a development, however, Mr. Parsons continued, while certain of accomplishment, concerns the more distant future.

COMPLETE GASIFICATION PROCESSES.

Touching upon the question of complete gasification, Mr. Parsons said that the Germans are manufacturing a gas of 200 B.Th.U. for 4 c. per 1000 c.ft. The plans for this low-temperature, continuous, complete gasification process are now in America, and are being given close scrutiny. Out in Ohio there are being witnessed the final stages of construction of another plant that will duplicate the German performance in the matter of low cost. The gas will be of a calorific value of nearly double that of the German product, and the estimated cost is about 10 c. per 1000 c.ft. in the holder. Additional experiments are going on in Virginia and other places, and the work has been carried forward to a point that justifies extreme optimism. In Ohio, it is proposed to heat homes as well as to supply industries. The plan is to serve one section of the city first, and then extend the area of distribution as the scheme develops. Recently, in a Western city, the calorific value of the gas was reduced from 500 to 425 B.Th.U., simply to determine the effect of such a change on the service rendered as well as on the public mind, and it was found that no one noticed the change, except those who were acquainted with the details of the experiment. The lower B.Th.U. gas burned just as well in all appliances.

Let all those who are fearful as to the future of gas try and suggest a possible substitute for this fuel, advised Mr. Parsons. More thought must be given to the possibilities of long-distance transmission, making it possible in many places to establish great central gas plants, either at the mines or in other favourable locations.

GAS WATER-HEATER BUSINESS.

The gas water-heater business was dealt with by Mr. Oscar H. Fogg, Secretary-Treasurer of the American Gas Association; the line taken by him being that water heating is one of the gas industry's most desirable and easily obtainable unfilled fields. In the first place, it means large volume, all-the-year-round business, which is the most attractive of all; and, secondly, it can be met without the necessity of any great extension of mains, which is a most important consideration. He believes that "Gas hot water" can be placed side by side with "Cook with gas;" but this can only be done by the most strenuous, persistent, and continuous effort, backed-up by the determination to give only the most perfect service possible.

METER DEPOSITS.

Messrs. B. B. Saul and E. J. Turley, of the Montreal Light, Heat, and Power Company, presented a survey of the more important publications on the subject of hardened diaphragms and gummy meter deposits, together with the results of investigations in the laboratories of their Company. According to the authors, the most novel explanation of the origin of the gummy deposit in meters is that advanced by Mr. R. L. Brown, of the United States Bureau of Mines, and Chairman of the Gas-Pipe and Meter Deposits Committee of the American Gas Association.* While not definitely established, Mr. Brown advances the theory of the polymerization of the unsaturated hydrocarbons of the gas—such as indene—as a possible cause of meter deposits.

The authors' explanation of an analysis made of sludge taken from meters at Montreal is that neat's-foot oil, consisting, as it does, mostly of the glycerides of oleic acid (an unsaturated acid), gradually becomes converted into a saturated acid by absorbing oxygen and hydrogen in the presence of certain catalytic agents. The oxy acids particularly produce a very hard fat, and the mixture of these glycerides dissolved in the hydrocarbons imparts the consistency which the meter deposit possesses. The effect of modern carbonization in aggravating this meter deposit now becomes obvious. High-temperature carbonization has reduced the oily constituents of the gas which not only protected the metal of the meters against corrosion, but likewise helped to maintain in solution any solid fats produced in the meter dressing. Also the modern tendency for heavier exhaustion pulls in a little extra air, thus enhancing the oxygen content of the gas, and accelerating the time of saturation of the unsaturated glycerides found in neat's-foot oil. The cause of these meter deposits, then, is the employment of a glyceryl-ester of an unsaturated fatty acid for a meter dressing; and so long as a lubricant of animal or vegetable origin is employed, the cause still remains. But mineral-oil dressed leather hardens and decays much more rapidly than that treated with neat's-foot oil, and so one is willing to employ the latter, in spite of the formation of objectionable sludge.

In the Montreal Company's meter shops it is now customary to pour about 3 oz. of pure neutral neat's-foot oil through the slide valves into the diaphragm, and to repeat the operation after five years' service. At the end of ten years' service, the sludge is removed. The authors find it difficult, from the varying experience with different meters, to arrive at a conclusion within any reasonable degree of accuracy as to the possible life of the leather or the reason for its hardening and perishing. The Company's records show that 30 p.ct. of leathers perish after fifteen years' service, and 50 p.ct. after twenty years. At present they are carrying out investigations with a view to ascertaining what effect local conditions have upon the useful life of leather diaphragms. In cleaning old meters, when the fronts and backs have been removed, the best solvent found for the deposit is benzole; but proper precautions against inhaling must be taken when using it.

(To be continued.)

* See "JOURNAL," Vol. CLIX., p. 327.

ANNUAL RETURNS RELATING TO GAS UNDERTAKINGS.

Board of Trade Statistics Regarding Companies (to Dec. 31, 1920) and Local Authorities (to March 31, 1921).

THERE were issued last week by H.M. Stationery Office the Board of Trade Returns relating to all authorized gas undertakings in the United Kingdom in the hands of Companies, for the year ended Dec. 31, 1920 (price 10s. 6d. net), and also those for similar concerns belonging to Local Authorities for the year ended March 31, 1921 (price 7s. 6d. net). The returns for the year immediately preceding were noticed in the issues of the "JOURNAL" for Dec. 1, 1920 (p. 506), and April 6, 1921 (p. 24).

COMPANIES.

The undertakings belonging to companies, with regard to which particulars are to be found in the return, number 508 (excluding two undertakings not furnishing returns). In the previous year, the number was 505 undertakings (excluding six not furnishing returns). Newcomers are Stocksbridge and Stourport; while Garnant, Kirkheaton, and Redcar no longer appear.

The total amount of the companies' capital (share and stock) authorized is stated at £100,790,584, as compared with £98,295,361 a year ago. The amount of share or stock capital (with premiums) shown in the present return as having been paid up is £84,094,626, which compares with £83,494,319 for 1919. The total loan capital authorized is now £29,427,396, and the amount issued £18,851,926. The receipts for the year under review amounted to £54,851,767, as against £43,037,484 for the year preceding; the expenditure being correspondingly greater at £50,629,209, compared with £39,134,309. The receipts and expenditure over a series of years (excluding the war period), together with some of the figures quoted above, will be gathered from the following table.

Financial Position Summarized.

Year.	Share and Premium Capital Paid-up.	Loan Capital Issued.	Receipts.	Expenditure.
	£	£	£	£
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933
1909. . .	74,952,664	15,168,298	19,951,779	15,097,658
1910. . .	76,797,028	15,396,163	20,446,438	15,308,928
1911. . .	77,382,751	15,606,929	21,134,770	15,903,361
1912. . .	77,963,589	15,816,405	22,358,030	17,231,015
1913. . .	78,903,298	16,269,757	23,296,963	18,580,794
1914. . .	*	*	22,814,641	18,556,692
1919. . .	83,494,319	18,318,312	43,037,484	39,134,309
1920. . .	84,094,626	18,851,926	54,851,767	50,629,209

* Information not available.

In 1920, the quantity of coal carbonized by the companies was 11,231,668 tons; and in 1919, 10,596,697 tons. The quantity of gas made was: Coal gas, 136,538,701,000 c.ft.; water gas, 29,283,343,000 c.ft.; and "other gas," 5,228,324,000 c.ft.—total, 171,050,368,000 c.ft., as against 160,826,784,000 c.ft. (including 28,723,808,000 c.ft. of water gas, and 4,487,047,000 c.ft. of "other gas") in 1919. The total length of mains belonging to the companies in 1920 was 24,116 miles, and in 1919 24,079 miles; and the public lamps supplied numbered 312,904 in 1920, as compared with 273,100 in 1919.

Gas Manufacturing Statistics.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Cubic Feet of Gas Sold.	Number of Consumers.
1905	8,722,145	109,823,682,000	100,848,445,000	2,813,156
1906	8,922,781	114,528,923,000	105,218,682,000	3,023,619
1907	9,240,280	118,699,705,000	108,239,449,000	3,230,993
1908	9,281,738	119,985,109,000	109,316,716,000	3,399,193
1909	9,175,532	122,930,431,000	112,334,153,000	3,573,796
1910	9,236,081	125,830,234,000	115,342,163,000	3,751,703
1911	9,431,841	130,562,246,000	119,497,425,000	3,906,528
1912	9,563,219	137,007,569,000	126,001,893,000	4,062,289
1913	10,118,399	142,251,637,000	130,175,199,000	4,214,865
1914	9,836,265	145,847,410,000	132,839,119,000	4,342,692
1919	10,596,697	160,826,784,000	145,880,443,000	4,510,595
1920	11,231,668	171,050,368,000*	155,423,817,000	4,565,167

* Including 29,283,343,000 c.ft. of water gas, and 5,228,324,000 c.ft. of "other gas," and excluding 668,793,000 c.ft. bought in bulk.
† Excluding 774,197,000 c.ft. sold in bulk.

The information contained in the return is, as on the last occasion, set out in twenty-three columns, which have the same headings as before. The column giving the "Nature and quantity of other materials used for the manufacture of gas" contains mostly, of course, references to oil and coke, but there are exceptions. For instance, Derby used 4754 tons of breeze, Budleigh Salterton 2000 gallons of tar, Cardiff 28,718 tons of coke and breeze, Rhymney and Aber Valleys an amount of benzole not specified, Swansea 781 tons of anthracite, Yorktown and Blackwater 2470 gallons of hydrocarbon, Gravesend and Milton 6293 gallons of carburine spirit, Isle of Thanet a small quantity of enriching spirit, Rochester, Chatham, and Gillingham 9611 tons of coke and breeze and 2000 gallons of tar, Sevenoaks 1730 gallons of benzole, Sittingbourne 735 tons of coke and coke breeze, Hightown 1106 gallons of petrol and 476 gallons of hydrocarbon residue, Grantham 2580 gallons of gazine and 496 gallons of carburine spirit, Brentford 50,713 tons of coke and breeze, Uxbridge 643 tons of breeze, King's Lynn 1109 gallons of benzole, Tynemouth 8876 gallons of paraffin enrichment, Kingston-upon-Thames 4000 gallons of carburine, Brighton and Hove 7049 gallons of benzole, York 3454 tons of coke and breeze, and Alliance and Dublin 4314 tons of breeze.

Of the 5,228,324,000 c.ft. of gas made other than coal or water gas, the South Staffordshire Mond Gas (Power and Heating) Company supplied 5,084,732,000 c.ft., as against 4,351,760,000 c.ft. in 1919. The Hightown Gas and Electricity Company supplied 1,186,000 c.ft. of petrol-air gas. During the quarter ended Dec. 31, 1920, the South Metropolitan Gas Company made 25,446,322 therms [4,626,604,000 c.ft.] of gas, and sold 23,225,230 therms [4,222,769,000 c.ft.].

Quantities of gas purchased in bulk were: Kempston, 5,061,000 c.ft.; Wilmslow and Alderley Edge, 607,000 c.ft.; South Shields, 172,000 c.ft.; Romford, 387,000 c.ft.; Ferndale, 991,000 c.ft.; Rhymney and Aber Valleys, a quantity not stated; Fleetwood, 33,000 c.ft.; Rainford, 4,934,000 c.ft.; South Metropolitan Gas Company, 19,107,000 c.ft. and 30,794 therms [5,598,000 c.ft.]; Harrow and Stanmore, 667,000 c.ft.; Uxbridge and District, 64,535,000 c.ft.; United District Gas Company, 5,363,000 c.ft.; Rowley Regis and Blackheath, 15,957,000 c.ft.; West Staffordshire, 3,216,000 c.ft.; Horley, 1,047,000 c.ft.; Solihull, 9,221,000 c.ft.; Gomersal, 250,000 c.ft.; Sheffield, 505,799,000 c.ft.; and Stocksbridge, all bought in bulk.

The total make of water gas by the companies in 1920 was 29,283,343,000 c.ft., which compares with 28,723,808,000 c.ft. in 1919. The following are the references made in the returns by companies to percentages of water gas supplied.

Companies Stating Percentages of Water Gas Supplied.

Abingdon, max., 20; av., 10.
Aldershot, max., 30; av., 17·7.
Alliance and Dublin, max., 46·53; av., 30·27.
Aylesbury, max., 60; av., 20.
Banbury, max., not stated; av., 8.
Barnet, max., 36·7; av., 15·5.
Bath, max., 35; av., 23.
Bexhill, max., 44·31; av., 26·82.
§Bilston, max., 20; av., not stated.
Bishop's Stortford, max., 50; av., 35.
Bognor, max., 38; av., 20.
Bournemouth, max., 43·7; av., 32·88.
Brentford, max., 62; av., 42.
‡Bridgwater, max., 15; av., 2.
Bridlington, max., 53·1; av., 33·8.
Brighton and Hove, max., 49·28; av., 35·77.
Bristol, max., 23·54; av., 14·77.
Budleigh Salterton, av., 40.
Burnham, max., 30; av., 25.
Cambridge, max., not stated; av., 23·7.
Cardiff, max., 39·74; av., 34·43.
Cleethorpes, max., 22; av., 15·8.
‡Coatbridge, max., 36·47; av., 27·63.
Colchester, max., 57; av., 36.
Commercial, max., 40; av., 28·6.
Croydon, max., 43·7; av., 30·2.
Derby, max., 57; av., 20·01.
Dorchester, max., 41·9; av., 31·5.
Dorking, max., 30; av., 20.
Dudley, max., 56·4; av., 41.
Durham, max., 57·5; av., 2·5.
Dursley, max., not stated; av. 13.
Eastbourne, max., 22; av., 10.
East Grinstead, max., not stated; av., 1·2.
East Hull, max., 45·7; av., 32·5.
Eckington and Mosborough, max., 40; av., 29.
‖Falmouth, max., 25; av., 17.
Farnham, max., 20·6; av. 9·9.
Felixstowe, max., 20·5; av., 7·3.
Fleetwood, max., 11; av., 7·4.
Folkestone, max., 25; av., 8·3.
Formby, max., 33·3; av., 16·7.
Frodsham, max., 30; av., 25.
Gas Light and Coke Co., max., 28·71; av., 20·91.
Gorleston, max., 33; av., 28.
Gosport, max., 62; av., 40·47.
†Gravesend, max., 50; av., 20·7.
Grays and Tilbury, max., 41·41; av., 28·36.
Great Yarmouth, max., 40; av., 9.
Guildford, max., 30; av., 20.
Hampton Court, max., 32; av., 24.
Harrow, max., 49; av., 41.
Hartlepool, max., 38·1; av., 17·87.
Hastings, max., 31·82; av., 20·94.
Hornsey, max., not stated; av., 36.
Horsham, max., 25; av., 24.
Hull (British), max., 37·43; av., 28·17.
Ilford, max., 43·2; av., 31·83.
Ipswich, max., 32; av., 24·27.
Irthlingborough, max., 42·73; av., 4·40.
King's Lynn max., 30·5; av., 16·6.
Kingston-upon-Thames, max., 90; av., 45.
Knottingley, max., not stated; av., 20.
Lea Bridge, max., 35·2; av., 32·32.
Leamington, max., 38; av., 11.
Leighton Buzzard, max., 30; av., 12·6.
Lewes, max., 35; av., 19.
Liverpool, max., 50·6; av., 35·8.
Llantrisant, max., 20.
Londonderry, max., 30; av., 10.
Luton, max., 11; av., 5·7.
Maidenhead, max., 60; av., 51.
‡Maidstone, max., 42; av., 23.
Malton, max., 30; av., 1·7.
Marlborough, max., 46; av., 16.
Merthyr Tydfil, max., 16; av., 7.
Mid Kent, max., 44; av., 34·6.
‡Newark, max., 50; av., 45.
Newcastle-upon-Tyne, max., 20·34; av., 11·62 (for one week).
Newport (Mon.), max., 30·5; av., 26·2.
North Middlesex, max., 79·54; av., 56·42.
Norwich (British), max., 48·60; av., 32·87.
Ormskirk, max., 30; av., 15·7.
Pembroke, max., 30; av., 11·66.
‡Pinner, max., 20; av., 20.
*Plymouth max., not stated; av., 46·55.
Pontypool, max., 15; av., not stated.
Portsea Island, max., 41; av., 34.
Potteries (British), max., 28·8; av., 3·6 (15·6 p.ct during period in operation).
Prescot, max., 50; av., 13·1.
Preston, max., 33·3; av., 18·5.
Ramsbottom, max., 25; av., 15.
Reading, max., 48·1; av., 35.
Redditch, max., 41·24; av., 8·61.
Redhill, max., 28·52; av., 7·7.
Ripley, max., 14·62; av., 6·69.
Rochester, max., 33; av., 13·99.
Romford, max., not stated; av., 35.
Rugby, max., 53·7; av., 1·2.
Runcorn, max., 25; av., 20.
Rushden and Higham Ferrers, max., 27·96; av., 20·30.
‡Salisbury, max., 50; av., 17·76.
Scarborough, max., 53; av., 39.
Sevenoaks, max., 50; av. 30.

Sheffield, max., 7·67; av., 0·52.
Sheppey, max., 33⅛; av., 30.
Sheringham, max., not stated; av., 14.
‡Shrewsbury, max., 33; av., 25.
South Shields, max., 31·59; av., 8·53.
South Suburban, max., 30; av., 25·34.
Southampton, max., not stated; av., 32·87.
Southend, max., 54; av., 40·02.
Southgate, max., 60·2; av., 50·4.
St. Albans, max., 56; av., 32.
Staveley, max., 40; av., 22.
Stretford, max., 24·48; av., 14·77.
Sunderland, max., 10; av., 4·5.
Swansea, max., not stated; av., 36·72.
Swindon, max., 35; av., 22·1.
Taunton, max., 60; av., 41.
Tonbridge, max., 62; av., 56.
Torquay, max., 50·5; av., 33·6.
Tottenham max., 52; av., 25.
Trowbridge (British), max., 24·1; av., 15·6 (2·4 p.ct. over the whole period of twelve months).
Tunbridge Wells, max., 43·4; av., 29·1.
Uxbridge, max., not stated; av., 1·3.
Waltham Abbey, max., 35; av., 25.
Wandsworth, max., 31·7; av., 19·8.
*Warwick, max., 16·9; av., 4·6.
Watford, max., 27; av., 22.
*Wells, max., 15; av., 4·7.
Weston-super-Mare, max., 100; av., 27·6.
‡Wexford, max., 35; av., 30.
Weymouth, max., 25; av., 20.
Winchester, max., 61; av., 42.
Woking, max., 27; av., 18.
Wolverhampton, max., 41·8; av., 33 4.
York, max., 31·25; av., 15·54.
Yorktown, max., 21; av., 15·8.

* The return is for the year ended March 31, 1920.
† " " " " June 24, 1920.
‡ " " " " June 30, 1920.
§ " " " " Sept. 30, 1920.
‖ " " " " June 30, 1921.

An indication is given in the return of those companies with whom the price chargeable and the rates of dividend payable are regulated by an Order under the Statutory Undertakings (Temporary Increase of Charges) Act, as well as of those having a standard of calorific value.

The quantity of gas supplied in 1920 by companies to ordinary consumers was 96,676,738,000 c.ft.; to prepayment consumers, 54,891,272,000 c.ft.; and for public lamps, 3,855,807,000 c.ft.—making a total of 155,423,817,000 c.ft., excluding 774,197,000 c.ft. sold in bulk. For 1919 the figures were: Ordinary consumers, 92,551,580,000 c.ft.; prepayment consumers, 50,641,548,000 c.ft.; and for public lamps, 2,687,315,000 c.ft.—making a total of 145,880,443,000 c.ft., excluding 536,889,000 c.ft. sold in bulk. Of the consumers in the present return, 2,704,854 were prepayment, and 1,860,313 ordinary; the figures for 1919 being 2,693,890 prepayment, and 1,816,705 ordinary.

LOCAL AUTHORITIES.

The undertakings belonging to local authorities with regard to which particulars are to be found in the present return—which is for the year ended March 31, 1921—number 319 (excluding three undertakings not furnishing returns). In 1919-20, the number of undertakings included was 311 (excluding five undertakings not furnishing returns). The names included on the present occasion which were not in the previous return are the Redcar Urban District Council and the Bervie Corporation; while the Inverbervie Corporation and Invergordon Corporation have dropped out.

The total amount of local authorities' loans and the capitalized value of annuities authorized is put at £54,355,675, which compares with £50,665,739 for 1919-20. The amount borrowed, including annuities (not deducting the amount repaid) appears as £50,319,539, as against £48,165,805 for the year before. The loans repaid, annuities redeemed, and amount in sinking fund figure at £25,683,545, as compared with £24,518,078 in 1919-20. The receipts for the twelve months under review totalled £28,373,216, and the expenditure (exclusive of interest paid on loans, &c.) £25,631,372; the corresponding figures for 1919-20 being £22,776,613 and £20,230,061.

Financial Position Summarized.

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the Next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in Preceding Column.
1905-06 .	£39,401,896	£9,636,107	£7,085,710	£1,799,094	£798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341
1907-08 .	40,712,159	10,500,416	7,839,122	1,882,427	827,454
1908-09 .	41,435,988	10,506,480	7,998,776	1,905,810	659,445
1909-10 .	42,002,322	10,398,263	7,710,985	1,970,241	767,961
1910-11 .	42,490,504	10,829,758	7,902,451	1,963,015	973,934
1911-12 .	43,108,248	11,184,000	8,161,944	1,990,756	1,045,057
1912-13 .	43,681,976	11,910,340	8,799,164	1,980,247	1,157,674
1913-14 .	44,554,222	12,206,595	9,661,310	1,995,441	719,561
1914-15 .	†	11,993,881	9,653,194	†	†
1919-20 .	48,165,805	22,776,613	20,230,061	2,179,164	367,388
1920-21 .	50,319,539	28,373,216	25,631,372	2,325,716	416,128

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.
† Information not available.

The total quantity of coal carbonized by the local authorities in 1920-21 was 6,712,709 tons; and for the year before, 6,437,015 tons. The gas made was: Coal gas, 83,180,287,000 c.ft.; water gas, 8,941,836,000 c.ft.; and "other gas," 113,772,000 c.ft.—giving a total of 92,235,895,000 c.ft. (excluding 1,177,418,000 c.ft. bought in bulk). The make for 1919-20 was: Coal gas, 78,735,879,000 c.ft.; water gas, 9,908,229,000 c.ft.; and "other gas," 95,522,000 c.ft.—giving a total of 88,739,630,000 c.ft. (excluding 1,140,397,400 c.ft. bought in bulk).

Gas Manufacturing Statistics.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Cubic Feet of Gas Sold.	Number of Consumers.
1905-06 .	5,758,180	65,081,109,000	60,559,280,000	2,250,919
1906-07 .	5,923,476	67,312,153,000	62,726,524,000	2,339,914
1907-08 .	6,166,473	69,786,988,000	64,649,698,000	2,434,183
1908-09 .	6,112,569	69,933,629,000	64,640,679,000	2,516,927
1909-10 .	6,049,788	70,616,963,000	65,352,790,000	2,590,270
1910-11 .	6,161,702	72,903,220,000	67,491,765,000	2,666,146
1911-12 .	6,203,171	75,053,780,000	69,549,124,000	2,743,376
1912-13 .	6,489,268	78,485,145,000	72,920,576,000	2,813,860
1913-14 .	6,853,325	82,265,530,000	76,299,274,000	2,888,248
1914-15 .	6,847,822	84,104,515,000	78,068,257,000	2,955,315
1919-20 .	6,437,015	88,739,630,000	82,544,688,000	3,029,538
1920-21 .	6,712,709	92,235,895,000*	85,594,884,000†	3,070,055

* Including 8,941,836,000 c.ft. of water gas and 113,772,000 c.ft. of "other gas;" and excluding 1,177,418,000 c.ft. bought in bulk.
† Excluding 129,486,000 c.ft. sold in bulk, but including 701,000 c.ft. supplied free.

The information to be found under the twenty-three headings of the return is on similar lines to that on former occasions. As is the case in the companies' return, there is a column giving the "Nature and quantity of other materials (than coal) used for the manufacture of gas;" and in this, apart from oil and coke, the following figures appear: Buxton, 1100 gallons of oil and benzole; Barrow-in-Furness, 3015 tons of cannel; Manchester, 1,182,270 gallons of distilled residuum; Oldham, 29,076 gallons of benzole; Rochdale, 805 tons of breeze; Widnes, 657 tons of breeze; Wigan, 3625 tons of coke and breeze; Abergavenny, 92 tons of cannel; Yeovil, 400 gallons of gazine; Birmingham, 65 gallons of benzole; Coventry, 3474 tons of breeze and 6 tons of briquettes; Oldbury, 915 tons of breeze; and Portsoy, 8½ tons of carbide of calcium.

Quantities of gas purchased in bulk were: Ellesmere Port, 340,000 c.ft.; Chesterfield, 17,632,000 c.ft.; Southend-on-Sea, 5,497,000 c.ft.; Denton, 1,897,000 c.ft.; Thornton, 377,000 c.ft.; Rickmansworth, 40,002,000 c.ft.; Southborough, 32,647,000 c.ft.; Little Hulton, 24,410,000 c.ft.; Mynyddislwyn, 25,781,000 c.ft.; Huthwaite, 10,863,000 c.ft.; Bedwellty, 30,996,000 c.ft.; Neyland, 5,490,000 c.ft.; Batley, 1,198,000 c.ft.; Burley-in-Wharfedale, 17,503,000 c.ft.; Halifax, 459,000 c.ft.; Hipperholme, 5,047,000 c.ft.; Kingston-upon-Hull, 72,217,000 c.ft.; Middlesbrough, 656,803,000 c.ft.; Rotherham, 74,270,000 c.ft.; Swinton and Mexborough, 64,414,000 c.ft.; Wath, Bolton, and Thurnscoe, 89 575,000 c.ft. The Portsoy Corporation made 72,000 c.ft. of acetylene.

The total make of water gas by the local authorities in 1920-21 was 8,941,836,000 c.ft., which compares with 9,908,229,000 c.ft. in 1919-20. The following table shows the maximum and average percentage of water gas sent out by local authorities manufacturing this form of gas.

Authorities Stating Percentages of Water Gas Supplied.

**Aberdeen, max., 16·3; av., not stated.
Abertillery, max., 51; av., 28.
Accrington, max., 10; av., 10.
Ashford, max., 41·3; av., 7·4.
Ashton-in-Makerfield, av., 8·8.
Barrow-in-Furness, max., 24·08; av., 3·02.
Barry, max., 50; av., 20·8.
Batley, max., 40; av., 10.
Belfast, av., 22·97.
Birkenhead, max., 47·94; av., 35·20.
Birmingham, max., 31; av., 11·2.
§Blackburn, max., 21·67; av., 11·9.
Blackpool, max., 25; av., 9·3.
Burnley, max., 40; av., 22·9.
Carlisle, max., 15·1; av., 1·07.
Chelmsford, max., 28; av., 10.
Chorley, max., 12·89; av., 0·62.
Colwyn Bay, max., 20; av., 14..
Congleton, max., 30; av., 10.
Conway, max., 33·3; av., 33·3.
Coventry, max., 38·40; av., 27·36.
Denton, max., 30; av., 19.
Devizes, max., 70; av., 25.
Doncaster, max., 28; av., 18·25.
‖Dundee, max., 21·47; av., 8·18.
East Dereham, max., 32; av., 25.
*Edinburgh, max., 27·39; av., 16·69.
†Glasgow, av., 7·17.
Halifax, max., 5 to 6; av., 1·4.
Hebden Bridge, max., 3, av., 3.
Honley, max. 50; av., 30.
‖Johnstone, av., 25.
Kingston-upon-Hull, av., 27·3.
Kirkby-in-Ashfield, max., 35; av., 25.
Leeds, max., 15·8; av., 2·8.
‡Leicester, max., 36·07; av., 22·43.
Leigh, max., 10; av., 0·41.
Lincoln, max., 30; av., 12·2.
Llandudno, max., 75; av., 45 (approx.).
Longton, max., 20; av., 15.
Loughborough, max., 30; av., 25.
Macclesfield, max., 50; av., 5·7..
Manchester, max., 36·75; av., 19·95.
Mansfield, max., 29; av., 16.
Marple, max., 25 (approx.); av., 20.
Middlesbrough, av., 35·25.
Milford Haven, max., 30; av., 18.
Neath, max., 50; av., 27.
New Mills, max., 30; av., 5.
Newton-in-Makerfield, max., 38; av., 33·3.
Nottingham, max., 12·66; av., 9·24.
Oldbury, max., 56·4; av., 14·5.
§Oldham, max., 54; av., 25.
Plymouth, max., 63·85; av., 47·96.
Pontypridd, max., 37·48; av., 24·77.
Porthcawl, av., 25.
Poulton-le-Fylde, max., 10; av., 10.
Rochdale, max., 30; av., 22.
Scunthorpe and Frodingham, max., 50; av., 42·19.
Silsden, max., 20; av., 8·3.
Southport, max., 25·09; av., 4·28.
Smethwick, max., 25; av., 4·2
Stafford, max., 25; av., 25.
Stockport, max., 100; av., 31.
Stockton-on-Tees, max., 37·2; av., 14·6.
Stourbridge, max., 44; av., 26.
Teignmouth, max., 25; av., 15.
Tipton, max., 1·8; av., 1·8.
Tiverton, max., 17; av., 10.
Todmorden, max., 25; av. 12·5.
¶Torquay (St. Mary Church), max., 55; av., 53·1.
Tyldesley-with-Shakerley, max., 20; av., 20.
Walsall, max., 38·9; av., 22·7.
Warrington, max., 1·6; av., 0·9.
West Bromwich, max., 13·22; av., 4·43.
Widnes, max., 27; av., 11.
Wigan, max., 48; av., 21.
Wokingham, av., 11.
Wombwell, max., 5; av., 5.

* The return is for the year ended May 15, 1920.
† " " " " May 31, 1920.
‡ " " " " Dec. 31, 1920.
§ " " " " March 25, 1921.
¶ " " " fifteen months ended March 31, 1921.
‖ " " " year ended May 15, 1921.
** " " " " July 31, 1921.

It is pointed out in the returns that the average percentages of water gas supplied do not in all cases correspond closely with the relative quantities of water gas and of coal gas made. It is understood that the figures showing the coal gas made include in some cases water gas not produced separately from coal gas; while the figures showing the water gas made relate to water gas produced separately from, and subsequently mixed with, coal gas.

The total length of mains belonging to the local authorities was in 1920-21 16,216 miles, and in 1919-20 16,030 miles. The number of public lamps supplied with gas in 1920-21 was 309,893; and in 1919-20, 272,612.

In the year under review, the 3,070,055 consumers were divided up into 1,424,856 prepayment and 1,645,199 ordinary; while of the 85,594,884,000 c.ft. of gas sold, 57,718,167,000 c.ft. was for ordinary consumers, 24,614,620,000 c.ft. for prepayment consumers, and 3,261,396,000 c.ft. for public lamps. The total number of cubic feet supplied, as just quoted, excludes, as already pointed out, 129,486,000 c.ft. sold in bulk, but includes 701,000 c.ft. supplied free.

COMBINED RETURNS OF LOCAL AUTHORITIES AND COMPANIES.

—	Number of Authorized Undertakings included in Return.	Amount Authorized.	Paid-up and Borrowed.	Receipts.	Expenditure.	Quantity of Coal Carbonized.	Quantity of Gas Made.	Quantity of Gas Sold.	Length of Gas Mains.	Number of Consumers.	Number of Public Lamps supplied with Gas.
		£	£	£	£	Tons.	Thousand Cubic Feet.	Thousand Cubic Feet.	Miles.		
Companies' return .	508	*130,217,980	102,946,552	54,851,767	50,629,209	11,231,668	171,050,368	155,423,817	24,116	4,565,167	312,904
Local authorities' return	319	† 54,355,675	50,319,539	28,373,216	‡25,631,372	6,712,709	92,235,895	85,594,884	16,216	3,070,055	309,893
Total	827	184,573,655	153,266,091	83,224,983	76,260,581	17,944,377	263,286,263	241,018,701	40,332	7,635,222	622,797

* Share capital and loan authorized. † Loan authorized. ‡ Excluding interest, &c.

HOLOPHANE GLASSWARE AND SERVICE.

Anyone interested in scientific illumination may be recommended to pay a visit to the new and extended showrooms and laboratories of Messrs. Holophane, Ltd., in Elverton Street, Vincent Square, Westminster, or, if this is impossible, to procure copies of one or other of the beautiful series of photographs which the firm have prepared as booklets (accompanied by explanatory letterpress), dealing respectively with general, industrial, school, and church lighting. All these divisions are necessary, because, of course, the form of shade, globe, or reflector to be employed will depend upon the purpose for which a lamp is required, and the nature of the interior it is intended to illuminate.

The styles of Holophane scientifically designed glassware are many, for different problems have constantly to be faced, and new types are continually being designed to meet the advance in illuminants. But in going over the showrooms, one would imagine that they have at hand the means of providing under practically any existing conditions what is generally admitted to be one of the most important factors in securing good illumination—that is, proper shading. Each type of Holophane glassware (which, by the way, is manufactured in England) is the result of experiments conducted by the staff of illuminating engineers in the Company's laboratories, and the distribution of light arising through its use is accurately known. Protection of the eye from excess of light is achieved by this glassware with a minimum absorption of light. It softens the rays in directions where they might be troublesome to the eye, and re-directs them where they can be more usefully employed. But excellent as are the Holophane products, it was very early realized that the mere supply of appliances without information as to how to use them to the best advantage is not satisfactory. Service must also be rendered, besides supplying goods. Accordingly, the Company are prepared to plan-out lighting schemes and offer advice, in addition to supplying globes and reflectors.

Last week, an opportunity was afforded technical members of the Institute of Journalists to attend a Holophane demonstration; and, after a hearty welcome by Mr. H. Hepworth Thompson (the Managing-Director), the party were addressed by Mr. E. Stroud (the Chief Engineer), who said that the Company have consistently aimed at keeping abreast of progress in illuminating engineering, as exemplified by the discussions before the Illuminating Engineering Society. Through the discussions that have taken place since the movement originated fourteen years ago, not only have the fundamental principles of good lighting become much better understood, but the special requirements for different classes of buildings and various processes have been elucidated. Agreement as to the best practice is attained by such discussions, in which both lighting experts and actual users of light take part. Through this educational movement, the public have been taught to appraise good lighting at its proper value in the interests of health, safety, and efficiency of work. The propaganda of the Holophane Company, in the form of pamphlets, lectures, and demonstrations, has contributed very largely to the spread of this better knowledge of the benefits of good illumination; and the Company have thus rendered useful public service.

Mr. Stroud interested his hearers by recalling that some of the earliest work in this country in the direction of endeavouring to secure control or direction of light rays over a particular area by means of prismatic lenses was done by Mr. A. P. Trotter, who devised such glassware in panels for use in the lanterns of arc lamps, which were then just coming into use. The light control, however, which was sought by Mr. Trotter did not approach by a long way the ideals which were at the same time occupying the attention of MM. Blondel and Psarondaki, in Paris. The outcome of their research evolved the scientific prismatic lighting glassware which they named "Holophane"; and the great value attached to this invention is manifested in the awards which were made to them by the highest scientific bodies in the world. Subsequently these ideas were developed to a more practical stage by the Holophane Company, with whom Mr. O. A. Mygatt is associated; and the development of scientific treatment of illumination is largely due to his initiative. The Holophane Company have based their efforts on all this collective experience, going back over a period of nearly thirty years; but, as has already been remarked, they are constantly adding new designs and introducing fresh developments to keep pace with progress in illuminants and greater knowledge of illuminating engineering.

The Holophane system is based on the use of prismatic glass, and in the original designs involved the employment of two kinds of optical prisms. The interior flutings accomplish the diffusion and breaking-up of the light rays. The horizontal exterior prisms have a second distinct purpose—namely, to direct the diffused light in a suitable manner, mainly in useful downward directions. These outside prisms generally consist of four independent surfaces, the angles and inclinations of which are accurately calculated to give the desired distribution of light.

The later introduction of reflectors, with an inner smooth surface and an outer surface formed of vertical prisms acting by total internal reflection, marked a distinct advance. The feature of this method is the accuracy with which any desired distribution of light can be obtained. This distribution is determined largely by the contour of the reflector, as well as the nature of the prisms, and the percentage of light that can be reflected by "total internal reflection" is extremely high. The absorption by globes is only about 12 p.ct. on the average, while in reflectors an absorption of only 5 p.ct. is found. Each Holophane globe, bowl, or reflector gives a certain distribution of light, adapted to a specific purpose. Diagrams illustrating these results are produced in the Company's laboratories and are furnished to users, so that the resultant illumination in any installation can be predicted, and units spaced-out to give uniform illumination.

The Holophane engineers were, Mr. Stroud explained, the first to recognize the need for a compact range of reflectors of different sizes giving the types of light distribution required to meet satisfactorily normal commercial conditions. These requirements were found to group themselves naturally into three classes of lighting service; consequently three types of Holophane reflectors were designed, which are now the well-known extensive, intensive, and focussing types.

Many special units adapted to the lighting of streets, shops, churches, factories, &c., have been developed; and more specialized devices—among which the new "artificial daylight" units (furnishing a light suitable for colour matching) may be mentioned—have also been evolved.

During the demonstration special attention was drawn to the usefulness and accuracy in measuring illumination of the "Holophane-Lumeter," which fits into a small leather case that can be carried over the shoulder.

Before the visitors left, their thanks to the Holophane Company were voiced by Mr. Leon Gaster.

Research for Metals Industry.—A pamphlet on "Research Work in Progress" has just been issued by the British Non-Ferrous Metals Research Association, of No. 71, Temple Row, Birmingham. The investigations in hand cover many important problems of the copper, brass, aluminium, nickel, and lead industries, as well as subjects of importance to users.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Opening Meeting in Edinburgh.

The Opening Meeting of the thirteenth session of the Scottish Junior Gas Association (Eastern District) was held in Edinburgh on the 7th inst., when there was a good attendance of members, and a sprinkling of representatives of Senior Associations.

Mr. ALEX. M'DONALD (Prestonpans), the retiring President, in handing over the office to his successor, Mr. W. A. Dearden (Dunfermline), expressed the hope that the members of the Association would accord to the new President a large measure of support in the coming session.

The new President's first duty was to present to Mr. M'Donald the President's Medal, for which the recipient suitably returned thanks.

Mr. DEARDEN then delivered his

PRESIDENTIAL ADDRESS.

The gas industry, notwithstanding the advent of its younger brother, still continues to flourish. I am given to understand that some fifty years ago gas was pictured in cartoons as a sinking ship; but thanks to the introduction of considerably improved manufacturing and distribution methods, the help of gas burner and appliance manufacturers, and the multiplicity of processes to which gas is now applied in industry, the same ship still remains afloat, in a more seaworthy condition than before. Whether the ship continues to resist the storms of competition, depends upon the resources of the present-day juniors. We are the midshipmen of to-day, who will be the officers of to-morrow; and we must emulate the example of our predecessors by keeping ourselves up-to-date.

EDUCATION.

The seniors, realizing that the future captains of the industry must necessarily be of the very best type, are considering a scheme of education for the guidance of the young men of the gas industry. As a lecturer in the Heriot Watt College, Edinburgh, I should welcome some set scheme, for to my mind the present educational facilities are chaotic. Through lack of the necessary guiding influence, one often finds a student attempting the study of gas manufacture without the least knowledge of chemistry or engineering. This is obviously a wrong procedure, because gas manufacture is a special branch of chemical engineering, the intelligent study of which necessitates a knowledge of the fundamental subjects. It seems, therefore, that any scheme of education should include in its preliminary stages a study of chemistry, physics, and engineering, leading up to the study of gas manufacture and supply in the final stages. The average student for the gas profession is already engaged in a gas-works or in a gas-plant manufacturer's works, and the time for study is limited to after working hours. Any scheme, therefore, should cater for this class of student.

In the case of mechanical engineering, commercial subjects, and the like, there is no difficulty in organizing evening courses in such a manner that the first year's students who pass the necessary standard of efficiency may go forward to the second year classes, and so on; while there are always ample recruits for the preliminary class. If a course of gas classes extending over a number of years, so as to cover chemistry, physics, engineering, and gas manufacture and supply, were to be attempted, even in the largest centres, I believe it would fail, owing to lack of students. It is my experience in Edinburgh that the college authorities will not consider the running of a first and final grade class simultaneously. This session I wished to take last year's successful first-grade students in gas manufacture through a final-grade course, and in addition hold the first-grade class. The small number of students who take advantage of these classes does not warrant the apportioning of more than one night per week to gas subjects; and the consequence is that the first-grade class has been abandoned.

Then, again, evening classes held in a centre serve the young men in the immediate neighbourhood only, whereas a large number of young men in scattered districts like the East of Scotland cannot avail themselves of any form of instruction except through the medium of correspondence classes. The time allowed for gas subjects in Edinburgh is one hour each for gas manufacture and gas supply. All a lecturer can hope to do in so short a time is to guide his students in their home studies; and, in my opinion, correspondence classes can accomplish this equally well. The latter form of instruction suggests to me a method of tackling the problem of the education of young men for the gas profession—that is, the formulating of a definite course of correspondence classes and examinations on a national basis, sponsored by the Institution of Gas Engineers. Then young men would no longer be at a loss how to proceed with their training.

Anyone, no matter where situated, could then enrol, at any time, for the first stage of the course, and know for certain that he would be guided year by year in the way he should go, with the ultimate goal in view of passing the final examination of the last stage with full diploma. To accomplish anything in life, a definite goal must be the aim, and then all energy is concentrated on the attainment of that definite goal. Such a diploma would, indeed, be a worthy goal for which to strive; and with such facilities at our disposal we could consider the raising of the status of our Junior Associations, as all young men of the gas profession would have equal chances of receiving instruction on properly organized lines. Whether such a national scheme would be practicable is difficult to foretell, and must be left to those in higher circles to judge; but I put this proposal forward for what it is worth. In any case, I am sure that the young gas men of to-day are eagerly anticipating some definite educational scheme.

THE PART OF THE JUNIOR.

By keeping thoroughly up-to-date, the junior may play his part in the stimulation of the demand for gas. Take first of all the lighting field, which, though very seriously contested, continues to be an appreciable source of income to gas undertakings. Fortunately we have supplied to us by burner manufacturers valuable ammunition with which to combat competition. As an example, I would mention the products of Messrs. Sugg & Co., samples of which I have for your inspection. These novel and attractive fittings are made in polished aluminium, and with the "Vitreosil" glassware provide a pleasing silver and white effect. Polished aluminium we have found, from many months' experience, retains its smart appearance, while the light diffused through the milk-white "Vitreosil" is remarkably soft and pleasant. The increased stability of the small-sized mantles, which are largely used, and the fact that a slightly broken mantle need not be replaced owing to the heat-resisting properties of the globe, combine to make such burners wonderfully economical. They secure splendid results from the gas consumed, and have been the means of saving to us a number of lighting consumers.

The recent catalogues issued by the foremost burner manufacturers illustrate numerous samples of the improvements in lamps for inside shop lighting, outside shop lighting, church lighting, street lighting, &c.; and a perusal of these will help to keep the junior in touch with the advancement in burner design. Knowing that many of the complaints of "bad gas" are traceable to "bad burners," it is conceivable that a junior with a knowledge of up-to-date burners and their capabilities may have the opportunity of introducing them to a consumer and convincing him that gas lighting is not by any means a back number.

Most of us are fairly familiar with the various types of gas-consuming appliances at the disposal of the public for heating, cooking, and other domestic purposes. Though the gas industry has not the same serious competition to face in this field, the principal makers of appliances have not been resting on their laurels; for to-day high efficiency burners have been evolved, and are now being incorporated in cooking stoves, range plates, and boiling rings, while the old-type straight bars are now being replaced by open sectional bars in hotplate construction. In this direction, again, the junior can be of service. When meeting friends in casual conversation, one is often made aware of a defective appliance, and a junior may pass this off as "something he cannot help." Do not neglect this class of complaint. If you cannot put the appliance right yourself, you know where a complaint should be lodged, and can accordingly report the matter for investigation by a competent man. Always bear in mind that the great aim of the industry must be a satisfied consumer.

We are kept in constant touch with the multiplicity of processes to which gas is successfully and economically applied by that excellent publication "A Thousand-and-One Uses for Gas," issued by the splendidly organized publicity department of the gas industry, the British Commercial Gas Association. Juniors can with advantage peruse this publication, and should lose no opportunity of making use of the knowledge thus gained.

HIGH-PRESSURE DISTRIBUTION AT DUNFERMLINE.

The undertaking which I have the honour to serve, under Mr. James Campbell, is one which can, among others, be put forward as an illustration of how the gas industry in general is progressing. I quote the following table from Mr. Campbell's report for the year ended May 15 last.

Year Ended	Gas Made.
May, 1913	145,367,000
1914	166,008,000
1915	184,411,000
1916	176,268,000
1917	166,961,000
1918	205,232,000
1919	218,700,000
1920	244,566,000
1921	252,336,000
1922	275,640,000
1923	300,000,000 (estimated)

Thus in ten years the output of the Dunfermline undertaking has doubled.

One of the factors which has materially helped towards this expansion is the extension of the area of supply, made possible by the utilization of high-pressure gas for distribution purposes. During the year to May 15 last, out of a total of 258,258,000 c.ft. of gas accounted for, we distributed 57,604,500 c.ft., or 22 p.ct., through high-pressure systems. We have four distinct schemes by means of which the high-pressure gas is utilized. The heart of the system consists of a Bryan Donkin steam-driven duplex reciprocating compressor, capable of compressing 50,000 c.ft. of gas per hour, against a pressure of 20 lbs. per sq. in. A stand-by plant is provided by two Bryan Donkin steam-driven rotary compressors. The outlet pressure maintained at the works varies according to the time of day from 2 lbs. to 8 lbs. per sq. in., so that meantime the main compression is not overworked.

Scheme No. 1.—This consists of a 6-in. Mannesmann main laid through the heart of the city. One of the rotary compressors is used alone to supply this scheme, which is solely utilized for high-pressure gas lighting. The main streets of the city, the Railway Company's locomotive sheds, a school, a factory, &c., are lit by this method. Most large towns now make use of high-pressure gas for this purpose. If the necessity arises, this main can be used to boost the city's low-pressure distribution system.

Scheme No. 2.—We have three instances of this method—namely, conveying the gas under high pressure to a convenient point in a compact district, governing-down the pressure there by means of a Reynolds district governor, and delivering the low-pressure gas into a trunk main which serves the district. H.M. Dockyard, Rosyth, is served through a 6-in. governor; Rosyth Garden City through a 6-in. governor; and the villages of Limekilns and Charlestown through a 4-in. governor. The Rosyth Garden City is by far the largest district, having taken almost 37 million c.ft. during the year ended May 15; and a brief description of this particular arrangement is representative of the other two. A 5-in. Mannesmann steel main carries the gas about 3 miles to a point almost central in the Garden City. A 6-in. branch is taken off, and led to a 6-in. Reynolds district governor duplicate. The governor is set to give a constant outlet pressure of 5½ in., the gas at this pressure being delivered directly into an 8-in. trunk main, from which the district is fed through an arterial system of low-pressure mains. The bulk of the gas used in the district is for cooking purposes. Consequently there are three distinct periods of the day when gas is required—breakfast, dinner, and tea time, the dinner hour demand being exceptionally high—while in between these times the requirements are very small. The Reynolds governor, therefore, works under somewhat exacting conditions, but notwithstanding gives the utmost satisfaction.

Scheme No. 3.—Some ten months ago we commenced supplying the Inverkeithing Gas Company with gas in bulk. The 5-in. main mentioned previously as supplying Rosyth was only 1¼ miles from the Inverkeithing works, and it was therefore a simple matter to take a 4-in. branch off this main and carry the high-pressure supply to Inverkeithing. On arrival at the works, the pressure is reduced by a 4-in. district governor, set to give 6-in. outlet pressure. The low-pressure gas is fed into the inlet of the old station meter, and thence to the gasholder. The Inverkeithing Gas Company then distribute through their old system of low-pressure mains. In this case the power of the Reynolds governor satisfactorily to maintain predetermined outlet pressure is continously tested by the works meter. If the governor failed in its work, and allowed the outlet pressure to bank-up, the meter seal would be blown. Thus far no mishaps have occurred.

Scheme No. 4.—This scheme has been evolved from an arrangement similar to that described under Scheme No. 2. With the old arrangement, a governor was placed between the works and the first of a string of seven villages, running for seven miles along the shores of the Firth of Forth. Originally this may have been more or less satisfactory; but owing to the rapid development of the most remote portion of the district, the governor outlet pressure had to be periodically raised; and finally it was found that, in order to provide even 1½ in. pressure at the far end of the main during the period of maximum demand, it was necessary to have a governor outlet pressure of 15 in. Thus, while village No. 1 was supplied with a dangerously high pressure, the last was poorly served. Two methods of improving the arrangement were considered, and both involved the conversion of the old trunk main into a high-pressure trunk main. The first plan was to take branches off the high-pressure main at each village, and deliver the gas through a district governor into low-pressure feeder mains; and the other was to govern each individual service or group of services. The latter method was adopted as being the cheaper, and also as lending itself to easier development in the future.

The work has been recently completed, and is now giving satisfactory results. It has necessitated the installation of nearly 200 governors; and as these are with very few exceptions fixed outside the consumers' premises, we had of necessity to prepare a method of recording the position and history of each governor, so that if any one of them requires attention it can be found without delay. A key plan of the whole district has been prepared, and each governor numbered, and the number entered on the key plan in the approximate position. A separate sketch on a loose leaf has been made, and the exact position of each governor and service recorded; while the governor number, size of governor, size of service, premises served, depth of governor pit, and date of installation are noted. Then if any particular consumer complains, his premises can be found on the plan, which gives the number of the governor serving the premises; and by turning-up this governor number, the exact position is found. All diaphragm governors require periodic oiling with suitable diaphragm oil; and a column is left on the sheet for the date of oiling, or any other noteworthy features in connection with the life of the governor.

We claim no novelty in these high-pressure schemes. I mention them in this brief manner because I think the description will be of some educative value to juniors, and also in the hope that when the informal discussion takes place at Dunfermline in January next, members may be prepared to discuss the various aspects of high-pressure distribution.

A discussion took place on the difficulties attached to running a successful educational campaign in the district, and opinions were freely exchanged. The general feeling of the meeting was that, unless the gas associations were to take an interest in the education of the juniors, or more facilities were granted by the educational authorities, correspondence classes were the most successful means of instruction.

Mr. Dearden was highly complimented on his address, and reference was made to the excellent syllabus arranged for the session. The hope was expressed that the members would respond fully to the meetings and visits.

Subsequently the members had tea together, and there was a smoking concert.

The next meeting is a joint one with the Western District, and takes place in Edinburgh on Saturday, Nov. 11.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Opening of the Session.

The opening meeting for the session of the Western District of the Scottish Junior Gas Association was held on Saturday last, in the Technical College, Glasgow. Mr. James Cubie (the retiring President) occupied the chair at the outset, and was accompanied by the new President, Mr. W. J. Lennox, of Falkirk. There was a very large attendance of members.

The Chairman expressed his pleasure at seeing so good an attendance. Every effort had been made to make the programme for the session now entered upon as attractive as possible. In passing, he should like to call attention to the enormous amount of work that had been done by the Secretary (Mr. Munro) in arranging the syllabus for the year. It was to be regretted that only one member of the Western District competed for the special prize presented by Mr. John W. M'Lusky. Mr. Walter Patterson's effort, however, was an excellent one, and quite merited the prize. Those of the members, however, who attended the annual social meeting of the Association in the month of April last would recollect that Mr. M'Lusky in his remarks made it clear that he was considerably grieved to think that the members had been lagging in their interest. Mr. M'Lusky, it would be recalled, said he had come to the conclusion that the spirit of the young men of ten and twenty years ago did not seem to predominate now. The Council were most anxious to keep up the good name of the Western Juniors. He hoped that the members would enter into the spirit of this competition, and that instead of having only one paper at the end of the year for Mr. M'Lusky's prize there would be at least a dozen or two. Competitors were not required to enter into a lengthy treatise of the work. All they were asked to do was to write out some 100 words or so giving their impressions and reflections of each item in the syllabus. His suggestion to intending competitors was that they should make a note of the items of interest in the paper read. These might be amplified and polished up a little when they got home, and at the end of the session there would be no difficulty in presenting for adjudication an interesting review of the session's papers and activities. Proceeding, he referred to the fact that the Glasgow Corporation had placed a testing-room at the disposal of the Western Juniors. It was a matter of regret to the Council that the premises were not yet ready, and it might be the spring of the year before they could enter into possession. Still he would like to impress upon the members the fact that Mr. M'Lusky was most anxious to assist them in every way possible, and he was keen to make the testing-room a place of real practical value to the Juniors. It would be noticed with satisfaction that Mr. Stones, the Assistant General Manager of the Department, was with them that evening; and in the absence of Mr. M'Lusky he might be able to give them a hint or two regarding the scheme that the Glasgow Corporation had in view. In vacating the chair, he (Mr. Cubie) desired to express his thanks to the members of the Association, the Council, and the Secretary for the co-operation and assistance they had given him during his term of office. His hope was that the same loyalty and help would be extended to his successor in the chair.

Mr. Lennox, in taking the chair, thanked the members most heartily for the honour they had conferred upon him. He then proceeded to deliver the following

PRESIDENTIAL ADDRESS.

GAS ENGINEERING.

The great improvement that has taken place in the industry during the last century is truly wonderful. Rapid progress has been made in the art of gas making, with the result that retort-houses are now one moving mass of machinery. Looking at the position from a prospective point of view, we are faced with the fact that at no period in the history of the industry have we been confronted with such a spirit of evolution as is now before us.

The advent of the vertical retort in its various practical forms has quickened insight into carbonizing methods generally, and the reflex action upon the old system has been most beneficial. The difficulty that has had to be faced is choice of plant, and to-day the gas engineer has, lying to his hand, a good selection for his choice—some good, some not so good, but all of it an improvement on what we had before. It is here, I think, that the trained engineer has the advantage; for if he is not endowed with a good

training and a due sense of proportion and adaptability, a decision may be made which may cause trouble and worry and loss to the department of which he is the head.

It has been said that the gas industry, like all other great industries, is evolving its own kind of engineer; and the man who is responsible for the supply of light, heat, and power must have a high standard of efficiency before he can control this important service to the public. A great deal is owed to those engineers who have evolved the present system of carbonizing coal by mechanical means. When we look back over the years of patient toil, discouraging results, and disheartening criticism, we fail to pay them the tribute which is their due. The patents for the improvement of carbonizing go on apace; and every week we read of some new system being introduced. Even in the present system of verticals improvements are being carried out. This is a healthy sign, and shows that gas engineers of to-day are ever on the look out for the best and most efficient plant that can be designed. Some looked on the vertical retort with continuous steaming as being the last word in carbonizing; but it is now found that other systems claim attention, and in some places find favour. The Technical Press is full of reports regarding total gasification plants and the results obtained from them; and if the reports are correct, a greater revolution than what we have already experienced may be expected in gas making. Personally, I favour total gasification; and I am of opinion that it will be the gas-making system of the future. A few points in its favour are —the making of a cheaper gas, a larger production of sulphate of ammonia, no coke bings to glut the market, less space required, low labour cost, and first cost of plant much less than for present installations.

STEAM RAISING IN GAS-WORKS.

Attention has been given of late to steam-raising in gas-works, and some of the statements regarding it are worth thinking about. It is a subject of great importance, inasmuch as it is the main driving force employed for our various plants. Some engineers favour one kind of boiler and some another, but at times we forget that conditions which favour the Lancashire will not do for the water-tube boiler. The kind of fuel always plays an important part in the failure or success of either sort. But why should so much steam-raising plant be required in gas-works? Could not sufficient steam be generated from the waste gases in the vertical retort-bench to meet our needs? I am not considering works where tar dehydrating and benzole extractor plants are in use. Works which have not these plants could with a waste-heat boiler have sufficient to steam the retorts and supply the sulphate plant.

THE GAS-ENGINE.

I now appeal for a fuller recognition of the merits of the gas-engine. I have often wondered why gas engineers would not use it to drive the exhauster with suitable reducing gear. This could be done quite well; and likewise the scrubbers, coal breakers, elevators, and conveyors. I am sure that if proper attention and supervision were given to it, we could provide a cheaper motive power than the present one.

LIQUID PURIFICATION OF GAS.

The liquid purification of gas has again been revised. It is astounding that we are still using the same method of purifying as our grandfathers. According to some reports regarding oxide as a purifying agent, the time has now come for a change from the present clumsy method. Mr. E. V. Evans, in his paper before the Society of Arts, remarked that the removal of sulphuretted hydrogen by means other than oxide of iron has not yet been discovered. I do not subscribe to this statement; for Dr. W. B. Davidson's patent specification No. 23,696 of 1911, for purifying gas from sulphuretted hydrogen and carbonic acid by means of its own ammonia, consists in graduating both the pressure and temperature within the still; the pressure being regulated in such a manner that a comparatively high pressure is obtained in the part of the still from which the ammonia is collected, so that the gaseous ammonia may be recovered with a high degree of purity. The working pressures are so arranged that the gaseous ammonia when leaving the still may be passed through absorbers to remove any traces of the acid gases, carbon dioxide, and sulphuretted hydrogen remaining therein, and still have sufficient pressure to exercise a jet action within the condensers or scrubbers of the gas plant, so that the gaseous ammonia, or part thereof, may be thoroughly mixed with the gas to be purified. Then from these washers, scrubbers, or condensers the ammoniacal liquor, with the acid gases present, is collected and returned to the still, where the practically pure ammonia distilled off in gaseous form and under suitable pressure is again collected and returned to the scrubbers. By this means a continuously working purifying process is obtained, as the still has not to be stopped for the removal of the solutions.

We are indebted to Mr. F. W. Sperr, Chief Chemist to the Koppers Company, Pittsburgh, for the splendid paper he gave to the American Gas Association, in which he described the system of the removal of 90 p.ct. of the sulphuretted hydrogen by sodium carbonate. Not only does the sodium carbonate absorb sulphuretted hydrogen, but also hydrocyanic acid and some of the carbon dioxide. If in this system of purification all traces of hydrocyanic acid can be removed, the corrosive effects of this acid on pipes and meters would be a thing of the past.

Many of the larger gas-works have standing idle the benzole plants that were required during the war. These could be easily converted into good purifying systems, which would be a great advantage over the present system and would remove a blot from our industry.

SULPHATE OF AMMONIA MANUFACTURE.

Plant for the manufacture of sulphate of ammonia, like all other gas-works plants, requires attention and intelligence. Very few text-books have been written on the subject, but a few good articles have been contributed. These have been very valuable, and have created an interest in the matter.

The most important parts of the sulphate plant are the superheater, the still, and the saturator. It is very important that the ammoniacal liquor should be free from tar; and to ensure this, it is best to pump the liquor from the well to an overhead tank (any old boiler will do). The pipe from the tank to the superheater should project 6 in. up through the bottom, so allowing any tar that may come over with the liquor to settle down to the bottom, thus permitting the clean liquor to run to the superheater. The pipe should not be continuous, but should have a small tank or other vessel between the overhead tank and the inlet to the superheater, so providing an opportunity for seeing if the liquor is all right, and enabling the attendant to regulate the flow as required. An overflow pipe is necessary; and it must be of sufficient size to take away the liquor in case the pump is not stopped in time. From the level of the bottom of the tank, a length of pipe with a suitable cock can be connected to the overflow pipe, and all tar that has collected in the bottom of the tank can be run back to the tar well.

The still should be regularly cleaned, the bubbling hoods should be taken out, and all the crusty matter removed from the openings that are round the edges of the hoods. The practice also applies to the seal flanges on the section plates inside the still. Care should be taken that the hoods are put back to their proper places and made level, so that the steam would have good time contact with the liquor. It will generally be found that the lower part of the still is more corroded than the top, owing to the milk of lime chambers being in the bottom part of the still.

The superheater also requires attention; and sometimes if tar gets in round the tubes it hinders the superheater from doing its work. One way of cleaning it out is to drill a hole in the top and connect a steam-pipe. Let the steam blow-down through it for half-an-hour or so, then take off the small door on the bottom, and most of the tarry matter can be taken out. Superheater steam is a great advantage over the moist steam; the greater temperature is more conducive to a higher efficiency in the still. The important point in the successful working of the plant is to have the superheater and the still well lagged, and to keep the saturator clean.

DISCUSSION.

Mr. James Cubie said the President was anxious to elicit some discussion on the practical and thoughtful address he had submitted to them. While he was on his feet, he desired to convey the interesting news that 21 names had that night been added to the roll of membership. Then he was asked to state that the Secretary would be glad to have, by Saturday next (Oct. 21), an intimation from those who proposed visiting the Carron Iron Works, Falkirk, on Saturday, the 28th inst. An effort was being made to secure cheap railway fares from Glasgow, and arrangements would be facilitated if members would communicate to Mr. Munro their intention of being present.

Mr. John Wilson (Motherwell) remarked that, in introducing his address, Mr. Lennox had called attention to the fact that he was steering clear of works experience. He started off with the observation that the retort-houses of to-day were one moving mass of machinery. He (Mr. Wilson) was disposed to differ from this statement. In retort-houses where horizontal retorts were still in operation, a reference to a moving mass of machinery might be profitably applicable; but in works fortunate enough to have verticals, the impression given to strangers was that everyone about the place was dead. He had been told that the complete absence of noise had given people that impression, and certainly the position to-day stood out in marked contrast to the former period when noise was one of the distracting features of almost every retort-house. It seemed to him, however, that they had got educated into realizing that it was possible to get results in the manufacture of gas without undue noise. Mr. Lennox was inclined to be optimistic in his view of the future of total gasification plant. On this question he was not so sure as the President appeared to be. The truth was that the total gasification plant had, like everything else, to be tried in the fiery furnace of experience. This had to happen before they could say that a total gasification plant was "It." Already he had heard quite a lot of tales about total gasification plants—some good and others not so good. They had always to remember their poor old friend the consumer; and it was their duty to him as gas managers not only to sell the best possible gas, but to supply it at the cheapest price. Mr. Lennox regarded it as astounding that in the sulphate plant they were to-day following the methods that their grandfathers did. He agreed that it was astounding, because it really showed how far forward their grandfathers were. In the references he had made to sulphate plant, the President had omitted one essential—the operator. He had always held the view that the art of sulphate making was a gift. Most of them, he supposed, had found from experience that one man could make excellent sulphate, whereas another individual would be a complete failure at the work. It was for this reason they should stress the importance of operators in the manufacture of sulphate of ammonia.

Mr. J. M'Isaac (Glasgow) said that some of the total gasification plants gave gas with 60 p.ct. of inerts in it. If this was to be the situation, then they were not going to be much further forward than they were now. As a matter of fact, the present system with water gas would give a much-improved result compared with that.

He was clearly of opinion that at all their works they ought to have a gas-engine on the premises which they could show to people when they called seeking advice in this direction. It did not look well if they had to explain to prospective users of a gas-engine that they had not such a thing in the works. A gas-engine should be on the premises so that they could give practical illustrations to prospective users of what could be done. He supposed an electric motor drive was to be preferred in most gas-works—especially in large undertakings—because it could start under load; and this of itself was a great boon. In a district, however, where both gas and electricity were run by the same concern, it might be profitable to have an inter-departmental arrangement.

Other members of the Association joined in the discussion; and at the close the President was cordially thanked for his interesting address.

SULPHUR COMPOUNDS IN COAL AND COKE.

Their Behaviour under Dry Distillation.

[J. P. WIBAUT, of Amsterdam, in Brennstoff-Chemie, Sept. 15, 1922.]

In the article from which the following is abstracted, the author gives an account of various researches which he has undertaken, in collaboration with Dr. A. Stoffel, from 1917 onwards, in the laboratory for organic chemistry of the Amsterdam University. Their object at the start was to devise an analytical method of determining separately the sulphur in pyrites and that contained in organic combination in coal.

SULPHUR IN PYRITES AND ORGANIC COMPOUNDS.

In order to arrive at this, a finely-powdered sample of coal, dried in air (passed through a mesh 900 per sq.cm.) was treated with a mixture (specific gravity 1·3) of benzene and carbon tetrachloride, and in this way divided into two parts. One of these was specifically lighter, containing some 0·8 p.ct. of ash, and the other heavier, and containing the major portion of the ash. The portion containing less ash showed a considerable sulphur content, which for the main part must be considered as organic sulphur. To determine the small quantity of sulphur contained in such pyrites as there might be in the low-ash sample, the iron pyrites was determined in the following manner: A portion of the sample was treated with dilute hydrochloric acid, to remove any soluble iron salts—such as the carbonate, &c. The sample was then reduced to ash at red heat, and the ash treated with hot 25 p.ct. hydrochloric acid. The iron extracted in this way corresponds with the iron pyrites of the coal, as any iron silicate it may have contained is not converted into oxide by the reduction to ash. In this way, therefore, a fairly accurate value is obtained for the sulphur in organic compound form in the low-ash portion of the coal sample, from which it is easy to calculate the organic sulphur contained in the original coal. They were satisfied that the mixture of benzene and carbon tetrachloride did not dissolve any sulphur compounds out of the coal. Only in the case of a Scottish cannel was this not the case.

A DIRECT METHOD.

In order to determine the organically compounded sulphur directly, the authors treat the original coal sample held in liquid suspension with bromine. Pyrites is fairly easily oxydized with a solution of bromine, whereas the organically combined sulphur in the coal is only slowly split-up by bromine. In fact, the low-ash portion of the coal sample treated with bromine in the manner described yields only a very small quantity of sulphuric acid, which quantitatively agrees with the iron pyrites contained in the sample. The method was checked by testing a mixture of finely-powdered pyrites and low-ash coal, and it was found that the pyrites was entirely oxydized by the bromine, provided it was not more than 5 p.ct. by weight of the coal. The detail of the method is to hold one gramme of finely-powdered coal in suspension with 100 c.c. of water. One c.c. of bromine is added, and the coal dust flocculates. It is then well worked with a glass rod, and heated on a steam bath for half-an-hour. After filtering and decanting a few times with boiling-water, the residue is washed with cold water until there is no reaction with silver nitrate (the coal treated with bromine will always give up HBr to hot water). The sulphuric acid in the filtrate is then determined gravimetrically. This corresponds with the inorganically combined sulphur contained in the coal. As the latter generally contains very little sulphur in sulphate form, which, moreover, can be easily determined separately, the bromine method gives principally the sulphur in the pyrites of the coal. The method lays no claim to great accuracy, but may be considered good enough for many practical purposes.

SOME FIGURES.

The results of tests on three English gas coals are then given. From the figures it is seen that, while in the original sample of coal A there is good agreement between the pyrites sulphur determined according to the bromine method and that found from the iron pyrites contents, this is not the case with other samples. The figures rather indicate the probability of iron-sulphur compounds with low sulphur contents having been present as pyrites in these samples. In any case the bromine method can only be regarded as an approximate one. The author expresses the hope that others will test the usefulness of the simple method described. The separate determination of the sulphur in pyrites and that which is organically combined is at any rate necessary to a thorough knowledge of the elemental composition of any particular coal.

—	Original Coal.	Low-Ash Portion.	High-Ash Portion.
	Per Cent.	Per Cent.	Per Cent.
COAL A (South Hetton)—			
Ash	9·4	0 70	11·05
Volatile	31·7	36·3	30·0
Total S	1·72	1·18	1·94
S as sulphates	0·04	..	..
S oxydized by Br.	0·89	0·20	0·90
Iron pyrites (estimated as Fe_2O_3)	0·94	0·21	1·44
COAL B (Boldon)—			
Ash	9·4	0·81	16·3
Volatile	33·0	35·0	30·3
Total S	1·98	1·37	3·01
S as sulphates	0·01	..	..
S oxydized by Br.	0·91	0·19	1·84
Iron pyrites (estimated as Fe_2O_3)	1·56	0·17	2·77
COAL C (East Hetton)—			
Ash	6·1	0·91	12·4
Volatile	34·1	35·3	29·9
Total S	2·04	1·23	3·43
S as sulphates	0·03	..	..
S oxydized by Br.	1·33	0·31	2·42
Iron pyrites (estimated as Fe_2O_3)	1·96	0·53	4·56

A NEW SULPHUR TEST.

A digression is here made in order to describe an interesting method recently worked-out by Prof. H. ter Meulen for determining the sulphur in organic substances, and also in coal, oil, gas, &c. The substance to be tested is heated in a stream of hydrogen until it is vaporized or decomposed. The vapours or the products of the decomposition mixed with hydrogen are then passed over a heated layer of platinized asbestos 20 cm. in length. Any sulphur present is thus converted into sulphuretted hydrogen, which is then determined by titration or colorimetrically. When dealing with small quantities, it is claimed that the method is quick, and sufficiently accurate. In the case of coal, ter Meulen mixes his sample (50 mg.) with a little borax. With coke containing much sulphur—such, for instance, as petroleum coke—the sulphur is only very slowly removed by the hydrogen. In this case the coke sample can be mixed with sodium potassium carbonate before heating in the hydrogen stream. The resulting alkaline sulphides can then be decomposed by passing hydrochloric acid fumes over them.

SULPHUR COMPOUNDS AND DRY DISTILLATION.

A low-ash coal sample was taken, and coked in a porcelain tube; the temperature being slowly raised to bright-red heat and maintained until no more gas was yielded. The sulphur remaining in the coke was determined, and the quantity of sulphuretted hydrogen given off during the distillation. The same experiment was carried out with the original coal sample. The coals before distillation gave the following analyses:

—	Original Coal.	Low-Ash Portion.
	P.Ct.	P.Ct.
Ash	7·7	0·7
Volatile	30·0	37·5
Total S	2·07	1·10
S as sulphates	0·02	..
S in pyrites	0·70	0·10
Organically combined S	1·37	1·00

The distribution of the sulphur as a result of dry distillation is shown as:

—	Original Coal.		Low-Ash Portion.	
	P.Ct. by Weight of Coal.	P.Ct. of Total Sulphur.	P.Ct. by Weight of Coal.	P.Ct. of Total Sulphur.
S in coke	1·20	58	0·55	50
S as H_2S in gas	0·58	28·2	0·32	27
Organic S in gas and tar by difference	0·29	13·8	0·23	21

From this it is seen that when a coal with 0·7 p.ct ash and 1·10 sulphur (90 p.ct. of the latter being combined in organic form) was coked, 50 p.ct. of the total sulphur remained in the coke. The experiment also shows that the organic compounds of sulphur yield a large proportion of sulphuretted hydrogen.

FURTHER EXAMPLES.

The next table shows the sulphur contents in cokes made from the three gas coals mentioned earlier in the article, expressed as percentages of the total sulphur contained in the coals before distillation:

—	Coke from Original Coal.	Coke from Low-Ash Portion.	Coke from High-Ash Portion.
Coal A	62·9	51·7	62·0
,, B	59·0	50·1	51·0
,, C	67·3	62·6	60·7

(A = South Hetton. B = Boldon. C = East Hetton.)

This shows that, generally speaking, the low-ash samples yield cokes which contain 50 to 60 p.ct. of the total sulphur of the coal. The investigation in the case of coal A was carried further, as it had been ascertained that the whole of the inorganic sulphur was contained in the pyrites. The following results were obtained:

—	Original Sample.	Low-Ash Sample.	High-Ash Sample.
	Per Cent.	Per Cent.	Per Cent.
S in Coal A—			
Total S	1·72	1·18	1·94
Inorganic S	0·89	0·20	0·90
Organic S	0·83	0·98	1·04
S in Coke—			
Total S	1·67	0·96	1·72
Inorganic S	0·51	0·16	0·63
Organic S	1·16	0·80	1·09

The surprising thing in connection with these figures is that the proportion of organic to inorganic sulphur is greater in the coke than in the coal from which it was made. The only feasible explanation of this seems to the author to be that part of the sulphur which in the coal was combined with iron becomes, through the coking process, combined with carbon—a reaction which, he states, has recently been observed also by Parr and Powell. The latter has proved that the combination with carbon of sulphur previously in pyrites takes place mainly at temperatures above 500° C. It is certain, therefore, states the author, that one or more fixed sulphur-carbon combinations are present in coke. These sulphides of carbon have their origin partly in the organic sulphur compounds of the coal, and partly in the sulphur yielded by the pyrites of the coal.

Synthetic Sulphides of Carbon.

In pursuance of this theory, experiments were carried out with the object of producing synthetically sulphides of carbon of this kind. The results of efforts in this direction with pure amorphous carbon and sulphur in one case, and low-ash wood charcoal and sulphur in another, are described. Briefly stated, the experiments showed that sulphur vapour is fixed at higher temperatures by amorphous carbon, a chemical combination taking place. Nothing can be said as to the exact composition of the carbon sulphides obtained, as no single uniform combination could be isolated. It is not even certain that combinations of constant composition enter into the question at all. At any rate, the carbon-sulphur compounds obtained were found to be closely analogous to the organic sulphur substances found in the coke from gas coals; their behaviour towards heat, oxydizing agents, and hydrogen being very similar.

Practical Results.

The researches described were undertaken primarily with the object of finding out what are the conditions which govern the production of coke and gas low in sulphur by dry distillation. In view of this, any results of practical importance which can be claimed are rather of a negative order. The experiments show that for the production of a coke low in sulphur, not much can be hoped for from the particular selection of coal to be carbonized. They point to the fact that even low-ash coal may yield a coke high in sulphur. It is, indeed, the organic sulphur compounds in the coal which produce sulphides of carbon in the coking process, from which the temperatures prevailing in coke-ovens or retorts do not expel the sulphur; so that, even if coal could be washed entirely free of pyrites, still not much would have been achieved in the direction of coke free from sulphur. Reference is made to laboratory experiments by which Powell succeeded in making coke practically free from sulphur, by the passage of hydrogen during coking; but the quantity of hydrogen required excludes any immediate possibility of practical usefulness for such a process. But in agreement with Wibaut's findings in connection with the synthetic carbon sulphides referred to above, Powell found that hydrogen worked quite distinctly, albeit slowly, on the carbon sulphides contained in finished coke. It remains to be seen whether any practical application of this is possible.

In conclusion, the author adds a note that, when he wrote his article, the interesting work of Förster and Geisler (since published in "Zeitschrift für angewandte Chemie") had not yet come to his notice. In so far as their findings agree, he claims priority for his work in collaboration with Prof. Stoffel.

Tapping a Holder Tank.—Mr. C. R. Henderson, of the Washtenaw (Mich.) Gas Company, referring to the necessity which in some cases arises of using a relief holder for the storage of tar or gas oil, points out that, rather than pump this material out, it could be drained out if there was a hole tapped in the water-tank, with valves attached. This can be accomplished by taking a small box with the top off, and tacking some padding round the edges, and then passing it down into the water-tank (by attaching it to a rod) to the point where the tap is to be made. The box can then be pressed firmly against the tank while the tapping is proceeded with. When the hole is through, the water that is on the inside of the box will, of course, run out at once; but the pressure of the water round the box will prevent the surrounding water from coming out, and a valve can thus be easily attached.

RESEARCH IN THE COKE INDUSTRY.

Reference to the bye-product coking industry is made by Mr. William A. Hamor, Assistant Director of the Mellon Institute of Industrial Research in the University of Pittsburgh, in an article on "Pittsburgh as a Chemical Research Centre" which has appeared in the "Journal of Industrial and Engineering Chemistry." Pittsburgh is surrounded by the richest bituminous coal section of the United States, and it is the cheapness of fuel which has attracted so many industries to the district. As a matter of fact, 50 p.ct. of all the coke in the United States comes from this area. For a number of years, the progress of bye-product coke making was slow; but in 1908 the industry received a marked impetus as the result of the activities of the United States Steel Corporation, who, after an exhaustive study of various European types of ovens, selected the Koppers design, and built a 280-oven plant of this character at Joliet (Ill.). This plant, which was equipped with the old indirect system of ammonia recovery, was successful beyond all expectations, and was rapidly followed by the construction of large plants using the Koppers direct process at Gary (Ind.), Fairfield (Ala.), and Duluth (Minn.). The writer says that the European war caused an enormous increase in the construction of bye-product ovens, and he expresses the opinion, judging from appearances at the present moment, that at the close of another decade little should remain of beehive coke manufacture. The Koppers Company's research laboratory in the Mellon Institute is excellently equipped with apparatus for coal carbonization at high and low temperatures, coal washing, coke research, gas purification by dry and liquid processes, furnaces for the investigation of refractory materials at high temperatures, experimental plant arranged for semi-commercial tests, and apparatus available for large-scale tests in relation to coke and gas manufacture and bye-product recovery. Among the research accomplishments are the recovery of benzene and toluene from carburetted water gas, the manufacture of coumarone and other resins and motor fuels, purification of ammonia-still waste, improved methods of gas purification, recovery of hydrogen sulphide, and special methods of coke investigation. The lines of research at present in progress are coal carbonization, gas production and purification, bye-product recovery, secondary treatment of various bye-products, general fuel research, refractories, pyrometry, and properties of coal.

In the same periodical, Mr. F. W. Sperr, jun., Chief Chemist of the Koppers Company's laboratories, discusses some subjects of investigation typical of the general trend of research in this connection, and remarks that the various investigators who have been working on the difficult and important problem of coal constitution have contributed much towards a fuller understanding of the coking property and the mechanism of coke formation. Coal research is, however, still in too early a stage to formulate strict generalizations, and investigators must not lose sight of the marked individuality possessed by each and every coal. In the Company's laboratories at the Mellon Institute, great emphasis is placed on the study of coke itself; and for some time past special attention has been given to specific gravity, porosity, and cell structure. The correct determination of the true specific gravity of coke is a problem the difficulty of which is not generally recognized. The figures obtained vary with the methods used; and since the porosity is calculated from the specific gravity, the discrepancies may be equivalent to as much as 30 to 50 p.ct. of the total variation in porosity found in different blast-furnace cokes. Since 90 p.ct. of all coke manufactured is consumed in the blast-furnace, the study of the effect of coke quality on blast-furnace operation is of prime importance. The inventor of the Koppers system has declared himself in agreement with the general opinion of American experts, that the most important property of coke for blast-furnace purposes is combustibility. The combustibility of coke stands in close relationship to the temperature of coking—the higher the temperature, the less the combustibility. Good blast-furnace coke ought to be made of homogeneous coal coked at moderate temperatures in such a way that the heating is uniform at all points in the coking mass, and should be pushed out of the oven as soon as coking is finished. Finally, it should be uniform in size. It has been shown by the Koppers system how the bye-product coke-oven structure may be modified to attain a greater uniformity of heat flow into the coking mass. Great progress has been made in this direction in recent American installations; and the Becker type ovens which have recently been put into operation by the Koppers Company at Chicago may be cited as the newest development that has been made, with remarkably successful results, in the regulation of the quality of the coke produced. The relation between the physical properties of coke and its utilization in the blast-furnace is being made a subject of study by the United States Bureau of Mines.

Midland Junior Gas Association.—The opening meeting of the session will take place in the Council House, Birmingham, tomorrow (Thursday) evening, when the new President (Mr. C. F. W. Rendle, of Redditch) will deliver his Inaugural Address. After the address, members will have the opportunity of inspecting the new Industrial Demonstration Rooms recently opened by the Birmingham Gas Department. Dr. C. M. Walter will be present with members of his staff to give information relating to the many types of gas-heated furnaces and industrial apparatus installed.

FRANCE'S MOTOR FUEL RESOURCES.

By Prof. A. Mailhe.

That our friends across the Channel have become anxious as to the future supplies of motor spirit, and are applying themselves sedulously to a solution of the problem, is evident not only from recent publications in our technical contemporaries, but from the organization in Paris of an international Liquid Fuel Congress, to which reference has already been made in our columns. A contribution on "The National Carburant," to an issue of the "Journal des Usines à Gaz," by Prof. Mailhe of the Faculty of Science at Toulouse, should go some way towards reassuring those who see dark clouds gathering over the development of motor transport. Some envy seems to exist at our own efforts to provide for the future, for he says: "Well-known are the attempts of England to secure the monopoly of petroleums in every country; while America is found by her side wherever a field is exploited." France is greatly dependent on foreign export, and must find means of supplementing her imports with home production.

At the present time, France consumes about 8 million hectolitres, or 600,000 metric tons, of spirit a year; and while an equivalent amount of alcohol would barely suffice as a substitute, her production of this commodity falls far short of that considerable figure. In 1900, she produced 2,656,000 hl.; in 1914, 2,503,758 hl.; and in 1920, 1,041,307 hl. Of this, nearly half-a-million hectolitres are required for various industrial purposes; so that when the output again reaches the peaks of 1900 or 1914, there will remain about 2,000,000 hl. for motor fuel purposes—sufficient to replace a quarter of the imported spirit. France has realized these limitations of her power, and has decided to aim at a one-in-ten or one-in-five mixture of alcohol and imported spirit.

A difficulty arises, however, in employing a simple mixture of this sort; for with 95° alcohol—industrially the best attainable—it is impossible to secure a homogeneous mixture, the alcohol separating on account of its higher specific gravity. It is found necessary to add a solvent; and Prof. Mailhe proceeds to examine the possibilities of various compound fuels. He himself has introduced several, and has been the recipient of an award in respect of one: Petrol, 1000 cub. cm.; 95° alcohol, 200 cub. cm.; and cyclohexanol, 100 cub. cm. Methyl cyclohexanol gives as good a result; and both these solvents may be produced readily by the hydrogenation of phenol or cresol in the presence of nickel. Their commercial preparation has been widely developed in Germany. Another good binder is isopropyl alcohol, obtained by treating acetone; and butyl alcohol, phenol, cresols, and resinous products have been suggested. Although the calorific power of alcohol is less than that of petrol, nevertheless the mixture is found to answer perfectly; and the value of the solvent largely compensates the loss. Running results have proved highly interesting.

France must thus be prepared to import three-quarters of her requirements, unless she or her colonies can find some substitute; and to fill the gap, attention has been called to benzole, the hydrides of naphthalene, and lignite oils. Benzole mixes readily, in any proportions, with alcohol; and records are obtainable of Germany having tried, during the war, a level mixture of alcohol and benzole, giving 6560 calories per litre; a 2 to 1 mixture, producing 5900 calories; and a 1 to 2 preparation, of 7180 calories. Benzole is worth 8000 to the litre; but excellent results were obtained with these mixtures. A 20 h.p. Panhard chassis (weight 1900 kg.) ran 100 kilos. on only 14½ litres of the 1 : 1 mixture (90° alcohol and washed benzole). This is equivalent to 19½ miles to the gallon of mixture; while an average performance on petrol is 14 miles to the gallon. Ignition may be sluggish in cold weather; but the addition of a little ether rectifies this—"Natalit" is a carburant composed of 49·5 p.ct. of 95° alcohol, 49·5 p.ct. of benzole, and 1 p.ct. of 65° ether.

French production of benzole can reach the figure of 80,000 metric tons a year; but in time of war it would all revert to the manufacture of munitions. Another source of home-produced spirit is naphthalene, from the hydrogenation of which tetralin is obtained—calorific power 11,300 calories per litre. Mixing it with an equal quantity of benzole gives 9800 calories; and with equal parts of benzole and alcohol (proportions which obviate difficulties of homogeneity) the resultant energy is 8350 calories—the fuel showing a run of 833 kilos. with 100 litres, as against 505 kilos. per 100 litres of petrol. With comparative ease the country could find 60,000 tonnes of tetralin; and more than this, providing the iron and steel trades get back their 1913 prosperity.

To the fuels enumerated above may be added a considerable volume obtainable by the distillation of lignites, of which France possesses several large deposits. Treatment of lignite renders at least 1 or 2 p.ct. of its weight of light oils, besides heavier distillates, suitable for lubricants; while the residuary coke, though very friable, may be used for briquetting. Thus, the carbonization of an output of 10 million tons of her lignite per annum would give her another 150,000 tonnes (say) of carburant, and save the importation of a quantity of lubricant. To summarize the above, shows a near approach to French requirements—namely, 600,000 tonnes.

Alcohol	160,000	tonnes.
Benzole	80,000	,,
Tetralin	60,000	,,
Lignite oil	150,000	,,
	450,000	,,

In addition, her own yields of petroleum from Pechelbronn, Mostaganem, and Morocco amount to 50,000 tonnes; and shale oils add to the quota.

Prof. Mailhe should have done much to comfort those who fear for France's starvation in motor spirit; and certainly his figures open the eye to the possibilities of home development in a country far less rich than our own in natural carbonaceous deposits.

Coke-Oven Gas for Large Engines.

Some particulars of an extensive power plant, operated by large gas-engines and driven by coke-oven gas, have been published by the "Iron and Coal Trades Review." This plant, which is installed at the Zollverein Colliery, is one of the largest coke-oven gas-power stations in Germany. The scheme includes the erection of 120 coke-ovens, the surplus gas of which was at disposal for power production. It was calculated that, by employing large gas-engines, surplus gas amounting to about 201,200 c.ft. per hour, with a minimum calorific value of 450 B.Th.U., would supply the required power. It has been ascertained from experience that large gas-engines need per horse-power-hour not more than about 10,300 B.Th.U., which works-out at approximately 13,500 B.Th.U. per kilowatt-hour. There are three twin-tandem double-acting four-cycle engines, each developing 4500 B.H.P., which are illustrated by our contemporary; and these have been working since 1914. The twin-tandem arrangement makes it possible that each side of the engine may be worked as a single-tandem engine, whereby a certain working reserve is provided. Special attention has been paid to the cylinder construction, important modifications having been introduced for the first time in the design of these engines. For one thing, the inlet and outlet valves are placed as near as possible to the working surface of the cylinder, as in steam-engine practice. Thereby not only is the loss of heat decreased, but the heat strains in the cylinder material are less.

The Hepburn-Forbes Gas-Turbine.

Writing in the "Motor Ship," Mr. W. A. D. Forbes indicates a proposed fresh line of development of the gas-turbine which is based upon a new theory of nozzle action, and involves the use of a novel type of pump known as a "kinetic compressor." He says that, in order to become a commercial success, it will not be essential that the gas-turbine should have an efficiency superior to the Diesel engine, but it will be necessary to obtain an efficiency greater than that of the steam-turbine, while, in addition, there should be considerable gains in weight and space. The gas-turbine may be operated upon three different types of cycle—heat may be taken in at constant pressure or at constant volume, or under thermodynamic conditions which vary between these states. As a matter of fact, they have actually been built and operated on each of these three cycles. In the proposed new Hepburn-Forbes system of operation, the sub-atmospheric, single-fluid, constant-pressure cycle has been adopted, as it is considered that this type of cycle yields the most promising line of development. Operating on this system, the calculations (in which reasonable allowances have been made for losses) show that an over-all efficiency approximating to that of the Diesel engine should be obtained; and there is therefore a wide margin for unforeseen contingencies between this value and the efficiency of the very best steam-turbine. Attention has been directed towards the utilization of the kinetic energy remaining in the gases after leaving the moving turbine blades; the gases on leaving the turbine being passed through a cooler, as far as possible without substantial reduction in velocity, and then into a "kinetic compressor," in which their velocity energy is converted into pressure energy. The vacuum throughout the system is maintained by the expansion, through a nozzle arrangement, of high-pressure operating air, in which fuel has been burned, thus enabling a further supply of air, in which fuel has been burned, at atmospheric pressure, to be induced to pass through the turbine and do work. Both supplies of air then pass through the cooler and "kinetic compressor," and are discharged at atmospheric pressure. The supply of high-pressure operating air is maintained by a mechanically-driven compressor, and can induce from four to five times its own weight of air to expand down from atmospheric pressure to the vacuum pressure, and pass through the turbine.

Gas Equipment for Garages.—Garages and motor repair works are daily increasing in numbers, and in connection with them gas has found a very important field of service. The latest issue (No. 104) of the British Commercial Gas Association's "Thousand-and-One Uses for Gas" has therefore been devoted to a description of modern equipment for such places which will prove of interest to owners of private cars, to proprietors of garages and repair shops, and to many others. The usefulness of the gas blow-pipe is emphasized, and then there is a photograph of a room built specially for drying paint and varnish on car bodies. In this room a regular temperature of from 65° to 70° Fahr. can be maintained day and night by means of circulating pipes with water heated by a gas-boiler outside the drying room. A Harvey-Frost vulcanizer—one of many which are now in use and giving excellent results at Newport (Mon.)—is illustrated, as well as a gas brazing-forge excellently designed to fulfil its purpose. Another chapter deals with the heating of garages. The price per copy is 6d., post free.

RESUSCITATION FROM CARBON MONOXIDE ASPHYXIA.

A Commission on Resuscitation from Carbon Monoxide Asphyxia, organized at the request of the American Gas Association, appointed a Sub-Committee to conduct investigations both outside and in the laboratory on the treatment of sufferers by an inhalation method which is described in a first report by Dr. Yandell Henderson and Dr. Howard W. Haggard, who, in carrying out the work, acted in collaboration with Dr. Stuart Scott. It is stated by them that recent investigations in the laboratory have confirmed the correctness of the view that carbon monoxide has no direct toxic action on the brain or other organs. It acts wholly through its combination with the hæmoglobin or red colouring matter of the blood. When so combined, the hæmoglobin is for the time deprived of the power to transport oxygen from the lungs to the tissues of the body. A condition of asphyxia therefore develops. The investigation has also confirmed the findings of previous workers—particularly Haldane—that the combination of carbon monoxide with hæmoglobin is reversible. That is, by the mass action of oxygen the carbon monoxide which has been absorbed may be again completely displaced. The oxygen-transporting power of the blood may be in this way completely restored.

The principal treatments hitherto proposed for carbon monoxide poisoning have been bleeding, transfusion, artificial respiration, and oxygen inhalation; but the last-named offers the one promising line of attack. Theoretically it is the obvious method for displacing carbon monoxide from the blood; but in practice oxygen inhalation has not fulfilled its theoretical promise—it needs some auxiliary agent. The ineffectiveness of oxygen alone appears to have been due to several causes. When a victim of profound asphyxia is given an oxygen inhalation, he breathes so poorly, draws so little of the oxygen into his lungs, and in consequence displaces so little of the carbon monoxide from his blood, that the benefits of the treatment are often for a time scarcely perceptible. After prolonged and profound asphyxia, some accessory factor is needed to stimulate the patient to vigorous breathing, so that he may draw the oxygen in, and thus wash the carbon monoxide out. The most natural means of obtaining this end is to supply enough carbon dioxide mixed with the oxygen to serve as an immediate stimulus to breathing.

Experiments were undertaken both upon animals and upon men. In the latter, a mixture of oxygen and 5 p.ct. of carbon dioxide was used, and no discomfort from headache, laboured breathing, &c., resulted, such as had been experienced with a higher percentage of carbon dioxide. Diagrams show that when breathing oxygen the rate of elimination of carbon monoxide is somewhat more rapid than when the subject breathes merely air, but that the elimination is enormously accelerated when the inhalation consists of oxygen, *plus* carbon dioxide. A blood concentration of carbon monoxide of 40 to 50 p.ct. saturation (a dangerous amount) was reduced to 10 or 12 p.ct. (a quite harmless amount) in half-an-hour.

Apparatus was designed to give a mixture of the desired proportions, and a trial under everyday conditions was made in Manhattan, which is supplied by the Consolidated Gas Company of New York. Twelve severe cases were dealt with, sufficient to afford a solid basis for the conclusions attached to the report. These conclusions are that manual artificial respiration by the prone pressure method should be employed when respiration has stopped, to start spontaneous breathing. This object may be assisted by administering oxygen and carbon dioxide simultaneously. Inhalation of oxygen and 5 p.ct. of carbon dioxide, by causing a very full ventilation of the lungs, rapidly eliminates carbon monoxide from the blood, and thus terminates the condition of asphyxia. This treatment is highly effective, inducing rapid and complete recovery, if applied early enough. (The necessity for treatment at the earliest possible moment is emphasized throughout the report.) It requires merely general medical supervision, and may be safely and efficiently carried out by intelligent men of the type composing the emergency gangs of a gas company. Until more definite knowledge has been obtained regarding the conditions in the lungs, brain, and elsewhere, subsequent to gassing, and until treatment can be based upon such knowledge and has been tested experimentally, it is inadvisable to apply any specific treatment to post-asphyxial gassing cases. The evidence reported indicates that oxygen *plus* carbon dioxide inhalation and rapid elimination of carbon monoxide greatly decreases the liability to nervous and pulmonary asphyxial sequels.

American Illuminating Engineering Society.—The sixteenth annual convention of the Illuminating Engineering Society of America was held during the last week of September, at Swampscott, a summer resort on the Atlantic Ocean, near Boston (Mass.). There were over 200 members and guests in attendance. A special feature of the meeting, and one which attracted crowds of spectators, was the lighting of sea and land by a 30,000 watt incandescent lamp (100,000 c.p.), and by searchlights of very high power. Fifty illuminated floats made the initials of the Society glow upon the face of the water. A number of papers and reports were submitted to the convention.

MOISTURE OVEN USED IN ANALYSIS OF COAL.

A moisture oven for use in the analysis of coal, which is described by Messrs. C. A. Lunn and G. H. Knobloch, of the Consolidated Gas Company of New York, in the "American Gas Association Monthly," is a modification of a large oven in use at the Pittsburgh Experimental Station of the Bureau of Mines. The Pittsburgh oven is of a capacity to accommodate 84 samples, and the construction is rather complicated; while the effort of the authors has been to design an oven of a size suitable for the average analytical laboratory, and of such simplicity that it can be built in the average machine shop. Their modified form consists of a brass drying chamber encased in a sheet-iron framework, and heated by means of a gas-burner of the oven type located beneath the drying chamber. This chamber consists essentially of two concentric pieces of brass pipe, each closed at one end and joined at the other end by means of a brass reducer, thus forming an inner and an outer chamber. The outer chamber serves as a container for the heating medium—a solution of glycerine in water. It has a copper tube coiled around the inner chamber, which conducts air through the heating medium and into the inner chamber, and is fitted with a gauge glass, drain cock, and openings for a condenser and a thermometer. The inner chamber contains a moveable brass sample tray, on the outer end of which is mounted a brass disc which serves as a door for the inner chamber. The sample tray contains twelve holes of a size to support a capsule $\frac{15}{16}$ in. deep and $1\frac{5}{8}$ in. diameter. The drying chamber and burner are supported within the sheet-iron framework by cross bars. A door on one side of the framework gives access to the burner, and vent-holes on both sides admit secondary air for combustion and carry off the products. After the drying chamber has been assembled within the framework, the space between the drying chamber and the framework is filled with a suitable insulating material, so that only the bottom of the drying chamber is exposed to the burner flames, over about one-quarter of its circumference. This oven has been in continuous operation for about eight months, and has given extremely satisfactory service.

In operation, the space between the inner and outer walls of the drying chamber is filled with a solution of glycerine in water of such proportions that the boiling solution maintains a temperature of 105° C. in the inner chamber. A return condenser keeps the concentration constant. The burner is lighted and the glycerine bath raised to boiling temperature. A current of air (dried by passing it through gas-washing bottles containing concentrated sulphuric acid, and preheated by passing through the copper coil already referred to in the bath) is forced through the inner chamber of the oven, and over the samples, at a rate that will renew the air in the oven from two to four times a minute. Two sulphuric acid air-washing bottles arranged in series are used for drying the air circulated through the oven. When the specific gravity of the acid in the first bottle has dropped to about 1·4, the acid is discarded and replaced with concentrated sulphuric acid. This bottle is then placed in No. 2 position, and the other bottle advanced to No. 1 position.

Steel Turnings for Scrubbing Water Gas.

Mr. John W. Batten, Assistant General Manager of the Detroit City Gas Company, quotes an experiment undertaken in the belief that steel turnings could take the place of wood shavings in a water-gas scrubber, and that they would possess the advantages of being semi-permanent, that a deposit of tar and oil could be washed-down with hot circulating liquor, and that the differential pressure through the tower would always be less than when wood shavings were used. The tower employed is located after the primary condenser, and is 9 ft. 6 in. in diameter by 40 ft. high. The shell contains two layers of steel turnings; the lower layer 13 ft. deep, and the upper one 10 ft. deep. The top of the shell is provided with sprays for running hot water over the turnings to clear them. Beneath the lower layer are sprays through which cold liquor may be pumped. One test showed 80 p.ct. of the tar removed, and another test 85 p.ct. Though a large proportion is thus taken out, a certain contamination of the material in the purifying boxes still goes on. It is too early to estimate the saving due to increased life of the purifying material; but Mr. Batten says "it will easily amount to a respectable sum." The differential pressure through the scrubber is from 3 to 7 in. of water.

Stone Dusting of Mines.—There has been published by Messrs. H. F. & G. Witherby, of No. 326, High Holborn, London, W.C., on behalf of the Lancashire and Cheshire Coal Research Association, as Bulletin XI., Part II. of a contribution to the study of the "Stone Dusting of Mines." It is by Mr. F. S. Sinnatt, M.B.E., M.Sc. (Tech.), F.I.C., M.Inst.Min.E., Director of Research to the Association, and Mr. A. M'Culloch, A.I.C., A.M.C.T., with a section by Mr. J. R. Lomax. The bulletin, which is priced at 2s., was prepared in order that members of the Association should have at their disposal a brief, but comprehensive, account of the principles underlying the problem dealt with, which affects not only the safety of mines, but the health of the miners. The authors state that the Mining Association of Great Britain has demonstrated definitely that coal dust is explosive without the presence of inflammable gas; that dustless zones were ineffectual; and that stone dust would extinguish an explosive flame.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Therms and Cubic Feet.

Sir,—The Fuel Research Board's letter to "The Times" of the 7th inst. indicates the depth of public feeling in this muddle, while it also indicates that the new basis of charge is the outcome of what had to be done by the gas industry during the nation's recent peril. Perhaps war-time measures have been accepted by the Board as normal practice. If so, one of the greatest and most useful of our public utility services is being slandered. This continued impeachment of the gas industry's integrity is reprehensible.

Gas companies always see to it that the quality supplied is in excess of the quality prescribed or declared. They lose nothing by so doing, inasmuch as the extra cost of production increases the price of gas, and is recovered from the consumer. The only constitutional factor affected is the potential value of the standard, basic, or maximum price, in dividend-earning capacity, and then only in negligible form. Gas administrators are not likely to sacrifice reputation, honour, and integrity by attempting to squeeze, for stockholders, a paltry increase of dividend by unscrupulous methods. The consumer's safeguard lies in the independent testing very properly provided by the Gas Regulation Act, and which, if reasonably carried out, is welcomed by gas companies; and, further, in the penalties which may be imposed on the stockholders' dividend for deficiencies in calorific value.

The Fuel Research Board's intention "that gas should be *bought* and *sold* on a definite thermal basis, founded on the continuous control of the calorific value of the gas supplied," is, however, a dream as yet, and will remain so while the volumetric meter lasts; for notwithstanding the Gas Regulation Act, the public *do not pay by calorific value, but only by volume as before, but with a guaranteed heat content*. As things are, the public mind has been absolutely muddled; and the introduction of the question of *inerts* in a discussion on *therms* will only queer the pitch.

May I repeat, Sir, that if the declared quality be stated on the gas bill, together with the equivalent price per therm, consumers would be satisfied *their therms would cost them less*, and the whole object of the Gas Regulation Act be achieved. The present difficulty seems to be in getting the Fuel Research Board to appreciate the distinction between a thermal basis of *supply* and a thermal basis of *charge*: both desirable, but only the former yet possible.

Oikonomia.

Oct. 13, 1922.

New Capital Issues.

Sir,—Gas companies requiring capital should take advantage of the present popularity of gas investments to make issues of debenture stock or preference shares before, or early in, the New Year—while the bank rate is low, and before the revival of trade which is reasonably expected to take place early next year. It is possible to place blocks of shares at the present time on very reasonable terms.

The matter of spending capital when obtained on works and plant is one of very serious consideration and responsibility to the gas engineer at the present moment. The next five years will see many important developments in the manufacture and purification of gas. Catalysis is going to play an important part in manufacture and purification, and will include the removal of the whole of the sulphur compounds, together with the CO_2. Gas oil, if this comes down in price to anything like the pre-war figure, will run coal pretty close in gas manufacture and industry generally.

C. B. Tully.

The Grey House, Carlton-on-Trent, nr. Newark, Oct. 16, 1922.

Gas Inspection Service in Canada.

Reporting to the Canadian Government Department of Trade and Commerce, at Ottawa, Mr. O. Higman, Director of Electricity and Gas Inspection service, says that the returns for the fiscal year to March 31 last show a considerable increase in the number of meters tested throughout the Dominion, indicating to some extent a return towards normal trade conditions. The actual number of gas-meters tested during the year was 118,299. The table setting forth the coal and water gas companies registered and gas tests made, enumerates 31 undertakings. In size they range from Toronto having 127,740 meters and Montreal with 121,713 meters, down to Sorel with 265 meters, and Coburg with 411. The average value of the gas supplied varied from 617 B.Th.U. in the case of Quebec, down to 454 B.Th.U. at Ottawa. Of the thirty undertakings, in connection with which tests were carried out, the average in thirteen instances was between 454 and 500 B.Th.U., in sixteen between 500 and 600 B.Th.U., and in one over 600 B.Th.U. The natural gas companies registered supply a far greater number of places, though the actual number of separate companies is about the same as those furnishing coal gas and water gas. The largest number of meters in any one location appears to be in use by the United Gas and Fuel Company at Hamilton (Ont.). In most cases the total falls far short of a thousand, and in many it is less than a hundred. In the Winnipeg district, there are half-a-dozen acetylene gas companies, but the total number of meters in use by them is little over 200.

Reduction in Price at Dorchester.—Another reduction in the price of gas of 1d. per therm, from 1s. 3d. to 1s. 2d., is announced by the Dorchester Gas and Coke Company, Ltd., to take effect after the September quarter meter readings. This reduction, together with that made at the end of June, is equivalent to 7d. per 1000 c.ft.

Gas Companies' Protection Association.—The 25th annual general meeting of the Association will be held in Caxton Hall, Westminster, on Thursday, Oct. 26, at 3 o'clock, when the report of the proceedings of the Association and the accounts and balance-sheet for the past year will be submitted. The re-election of Sir J. Fortescue Flannery, Bart, M.P., as President, and Mr. H. E. Jones and Mr. Charles Hunt as Vice-Presidents will be proposed.

REGISTER OF PATENTS.

Retorts for Low-Temperature Carbonization.
No. 185,778.

Low-Temperature Carbonisation, Ltd., of Cockspur Street, S.W. 1, Low-Temperature Construction, Ltd., of Westminster, S.W. 1, and Davidson, T. M., of Bromley.

No. 8723; March 21, 1921.

This invention, relating to low-temperature carbonization, has among its objects to prevent the adherence of the charge within the retort as the result of its expansion in the course of the distillation, to permit of the free egress of vapours and gases in the course of the distillation, and to permit of the charge freely falling on the bottom doors being opened. It especially relates to the subject-matter of specification No. 161,628, and provides simple and effective means for collapsing the plates mounted centrally within the retort.

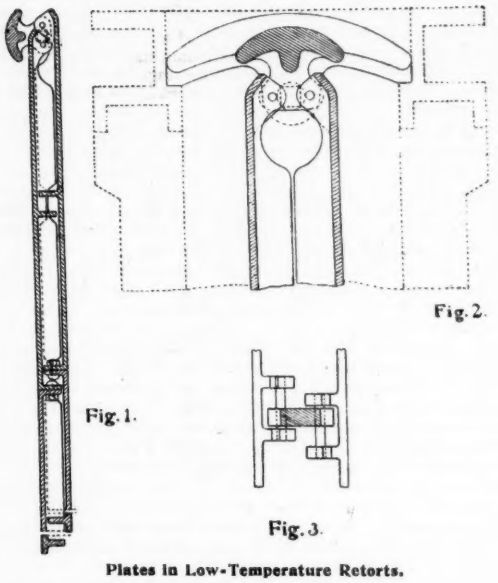


Fig. 1. Fig. 2. Fig. 3.

Plates in Low-Temperature Retorts.

The spindle from which the plates are suspended is formed as a beam pivotally mounted at its respective ends to permit of its rotation within the top frame parts of the retort. The main part of the section of the beam may, however, be provided of a curved form with a central downwardly depending rib extending the length of the beam; and lugs depending from the beam and extending on each side of the centre line are provided for the reception of pivoting bolts, which are passed through adjacent lugs integrally provided at the upper end of the plates. It will be understood that a beam of the form indicated has its longitudinal edges diverted downwardly.

The operation of rotating the spindle and beam is performed by means of a lever inserted through an opening in the upper part of the retort. On the lever being used to restore the plates to their "expanded" position, the lid is put on the lateral opening in the upper end of the retort, from which the lever is withdrawn; and the fuel is then charged into the retort. At the end of the carbonizing period the side cover is taken off for the purpose of inserting the lever, by the operation of which the plates are collapsed, the bottom door is opened, and the charge drops out. The lever is then returned to its original position, and a new charge put in. It will be understood that the curved form of the beam serves as a cover to prevent the passage of the fuel into the space between the plates in charging the retort.

Fig. 1 represents a sectional elevation in which the plates are shown in their closed position; fig. 2 is a detailed view on an enlarged scale, showing the plates expanded; and fig. 3 is a further detailed view showing the manner in which the plates are carried from the pins. The plates are formed in separate parts, which are secured together in the manner illustrated in the drawings, and are provided with internal vertical ribs and with transverse ribs; and the vertical ribs are provided with recesses to accommodate the transverse ribs when the plates are brought into proximity.

Mechanically Discharging Clinker.—No. 182,484.

Wood, H., of Mortlake, near Sydney, N.S.W.

No. 17,944; April 15, 1921. Convention date, April 15, 1921.

This invention relates to apparatus for mechanically discharging retorts and the like, and more particularly to the type comprising parallel rotatable shafts provided with rotary toothed members.

The object of the invention is to facilitate the discharge of the clinker. It consists in an apparatus comprising a series of rotary shafts each carrying a series of ratchet toothed discs, so arranged that the teeth of the discs on one shaft are staggered relatively to those of the discs on the adjacent shaft or shafts, so that while the teeth on one side of a disc co-operate with those of the next disc on that side, to pick and cut the clinker in an upward direction, the teeth on the other side of such disc move downwardly to crush and expel the clinker.

The invention also consists in providing bolted plates which normally hold the bearings of the shafts in position; the arrangement permitting

the shafts and their bearings to be readily withdrawn as a whole, so that the discs thereon may be removed. The shafts may be hollow, and water may be circulated there-through for cooling the shafts.

Manufacture of Carburetted Water Gas, &c.

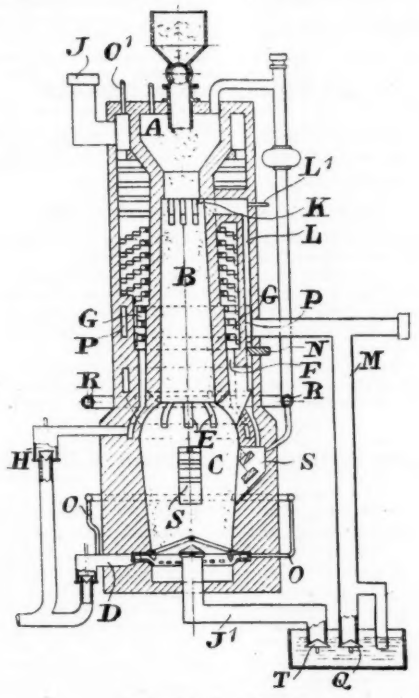
No. 185,887.

MURRAY, E. F., of King's Cross, W.C. 1.

No. 17,879; July 1, 1921.

This invention relates to gas generating apparatus of the kind in which a water-gas generator, operated on the usual "blow" and "run" system, is surmounted by a retort through which the fuel is fed to the generator; the gases produced during the blow (producer gas) being burnt in flues round the retort, and those produced during the run (water gas) being passed through the retort. The apparatus is so operated that the fresh fuel is preheated in the top part of the retort, above the off-take of the run-gas, by combustion of the blow gas, so that the fuel is dried, if necessary, and the greater part of its tar-forming constituents vaporized; the volatile matter thus formed being passed into carburetting chambers suitably heated by the generator, and thence into the run gas. By another feature of the invention, the run gas may be passed through ducts heated by the blow gas, so that the hydrocarbons may be cracked and a fixed gas produced.

The apparatus according to the invention may be constructed so that it can be used both for up and down running. It comprises, says the patentee, improvements in construction which will be understood by reference to the accompanying drawings, of which we reproduce a vertical section.



Murray's Gas Plant.

The construction may be described together with the mode of operation. The fuel is fed from a hopper through a mechanical feeder and a sealing chute into the top part A of the retort B, through which it passes into generator C, where it rests upon the grate bars. During the blow period, air under pressure is admitted into the ash-pit beneath the grate bars through pipe D and a perforated distributing duct. The blow gas leaves the generator through ports E and passes through ducts F into the secondary combustion chamber G. Here it meets secondary air admitted through valve H. The completely burnt gases now pass through ports into chambers, where they part with the greater portion of their heat to suitable brickwork, and thence to the stack pipe and the stack valve J.

It is claimed as a feature of the invention that during the first part of the blow (say ¾ minute) the valve J is closed, so that the blow gas (of comparatively high thermal value) passes up the retort A, expelling gases therefrom and passing together with these through ports K, ducts L, and take-off pipe M, and bye-pass; the valve N being closed. At the end of this first period, valve J is opened, whereupon the water seal in the bye-pass becomes operative and the blow gas takes the path to the valve J, as already described. The valve H being at the same time opened, secondary air is admitted and any combustible gas in the blow gas is completely burnt. When the fuel in the generator is sufficiently incandescent the air blast is cut off, valves J and N are closed, and steam is admitted to the distributing duct through pipes O. The run-gas passes up the retort B, through the ports K, down the fixing ducts L (which are heated by their close proximity to the brickwork chambers) into the annular collecting duct P, and through the off-take pipe M and valve Q.

The top part of the retort is expanded to form the chamber A, the sides of which are externally heated by the blow gas combustion products. Here the freshly-fed fuel is heated to a temperature which dries it and distils hydrocarbon vapours from it. These products are drawn by a blower through a pipe, and are forced into an annular pipe R. From this latter spring jet pipes which inject the complex vapours into the several carburetting chambers S. When it is desired to raise the calorific value and illuminating power of the gas produced, suitable liquid hydrocarbon may be injected into chamber A. In the carburetting chamber S, the jets of hydrocarbon vapour impinge upon baffles or plates which are kept at a high temperature by their contact with the incandescent fuel in the generator. Thus the vapours are cracked into permanent gases, and any steam present becomes water gas. These gases pass up ducts and through the ports E into the retort to join the water gas passing up.

As is known, it is generally desirable to operate a water-gas generator with alternate up and down runs. The present application is therefore constructed to permit of this alternation. After the up run has been continued for a period, damper N and valve T are opened and valve Q is closed; steam is cut-off from pipes O and admitted through pipe O^1 and also through pipes L^1 into ducts L. Pipe J^1 opens beneath the grate of the generator and forms the take-off pipe for the down run. The steam passes through the brickwork chamber G, L, F, and E, into the generator. The carburetting devices may continue to operate as in the up run, and the cracked products pass downwards through the fuel bed to leave with the gas by pipe J^1.

Before stating his claims the patentee calls attention to other structural features of his invention.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Oct. 11.]

Nos. 26,476 to 27,212.

BARRS, E.—"Production of coke from small coal." No. 26,948.
BERRY, J.—"Gas-meters." No. 26,994.
BILLINGTON, W. J.—"Gas cooking-stoves." No. 27,139.
COKE AND GAS OVENS, LTD.—"Method of producing white commercial pure ammonia chloride." No. 26,967.
COLLINS, G. A.—"Lever-controlled valves, &c." No. 27,119.
FRANCIS, A. F.—"Gas-heated laundry irons." No. 26,829.
GLOBE PNEUMATIC ENGINEERING COMPANY, LTD.—"Rotary compressor or exhauster." No. 26,732.
GLOVER, W. T.—See Berry, J. No. 26,994.
GRIEVE, E. J.—"Gas-producer plants." No. 26,783.
JACKSON, W. J. MELLERSH.—"Removal of hydrogen sulphite from gases." No. 26,715.
JOHNSON, P. G.—"Pipe, &c., joints." Nos. 27,109, 27,212.
JOHNSON, J.—See Globe Pneumatic Engineering Company, Ltd. No. 26,732.
KOPPERS COMPANY.—See Jackson, W. J. Mellersh-. No. 26,715.
LESCHOT, C.—"Gas heating and cooking stoves." No. 26,690.
LEVINGTON, C.—"Gas-jet for street-lamps." No. 26,797.
LEVINGTON, C.—"Gas-jet." No. 26,798.
LIVENS, F. H.—See Grieve, E. J. No. 26,783.
MARLOW, S. W.—"Nipple, &c., for attaching incandescent burner." No. 27,023.
METERS, LTD.—See Berry, J. No. 26,994.
MILLS, E. C.—"Gas-producers for steam-boilers." No. 26,635.
MUIRHEAD, A. E., J. G., & M. A.—"Lighting and heating." No. 26,478.
NICHOLSON, V. R.—"Flow-meters." Nos. 26,775, 26,776.
REES, T. L. H.—See Billington, W. J. No. 27,139.
ROGERS, J. F.—"Mechanism for stirring charge in gas-producers." No. 26,586.
RUSTON AND HORNSBY, LTD.—See Grieve, E. J. No. 26,783.
SHADBOLT, S. M.—"Valves, &c." No. 27,123.
SOC. LYONNAISE DES EAUX ET DE L'ECLAIRAGE.—"Process of gasifying and carbonizing coal, &c." No. 26,883.
SPENCER, J. H.—"Unions for pipes for high-pressure fluids." No. 27,066.
STILL, W. J.—"Internal-combustion engines and gas-producers." No. 26,856.
VICTAULIC COMPANY, LTD.—See Johnson, P. G. Nos. 27,109, 27,212.
WELLMAN SEAVER MORGAN COMPANY.—See Rogers, J. F. No. 26,586.
WETHERILL, R.—See Rogers, J. F. No. 26,586.
WRIGHT AND EAGLE RANGE, LTD., J.—See Francis, A. F. No. 26,829.
YEATS, H. E.—"Gas-heated radiators." No. 26,507.
YOUNG, E. R.—See Rogers, J. F. No. 26,586.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that the Société Anonyme de Construction de Fours à Coke "Simplex" have made application for the restoration of the patent granted to ALEXANDRE FOLLIET-MIEUSSET for "Improvements in or relating to the introduction of gas and secondary air into gas-furnaces," No. 1645 of 1911, and dated Jan. 21.

Walsall Gas Manager's Retiring Allowance.—There was some discussion at a meeting of the Walsall Town Council on Monday last week, of the recommendation of the Gas Committee (moved by the Deputy-Mayor, Mr. H. H. Tucker) that the resignation, as from March 31 next, of the Gas Manager and Engineer (Mr. B. W. Smith) should be accepted, and that, in consideration of his past faithful services, the Council should grant him from that date a retiring allowance of £250 per annum for the term of his life, subject to his agreeing to render such services to the Committee as they may require from time to time. Mr. Tucker, in the first place, assured the Council that this proposal would not cost the rates one penny, and that by re-adjustments it would be possible to save the amount over and over again. Paying a tribute to the services of Mr. Smith, he mentioned that during the 23 years he had filled the position the gas undertaking had contributed towards the relief of the rates no less than £98,500. Mr. W. Starks moved an amendment that the resignation be accepted, and that the remainder of the recommendation should be referred back to the Committee; but on being put the amendment was lost and the resolution approved.

MISCELLANEOUS NEWS.

LONDON COUNTY COUNCIL AND THE THERM BASIS.

Public Control Committee Suggest a Board of Trade Inquiry.

Among the matters to be considered at yesterday afternoon's meeting of the London County Council was a report by the Public Control Committee, dated Oct. 13, stating that they have had under consideration a large number of complaints from gas consumers alleging that, in consequence of the new method of charging for gas per therm, their accounts for the quarter ended last June were much in excess of the corresponding quarter of the previous year. They thought it very desirable that the Council should make representations to the Board of Trade with a view to their holding an immediate inquiry into the question, and recommended: "That, in view of the prevailing discontent, the Board of Trade be asked to institute an immediate inquiry into the question of the method of charging for gas by therm."

Mr. David Davis had given notice that he would propose: "That, having regard to the fact that the 'standard' price of gas per therm varies in different areas in London, and that apparently the costs and charges of, and incidental to, the production of gas have substantially altered, as is shown by the increased dividends paid by certain undertakings, it be referred to the Public Control Committee to consider and report whether the time has now arrived for the Council, as the local authority under the Gas Regulation Act, 1920, to apply to the Board of Trade, under section 1, sub-section 3, of the said Act, in the interests of consumers, to make amending Orders revising the present authorized standard prices."

GAS LIGHT AND COKE COMPANY.

Sliding-Scale for Dividend on Ordinary Stock.

The subjoined table, which has been prepared by the Gas Light and Coke Company, of the revised sliding-scale for dividend on their ordinary stock will be of considerable use not only to proprietors but to investors generally, as showing the maximum dividends that may be declared, at the discretion of the Directors, with the Company's standard price of 15·2d. per therm, at prices per therm ranging from 15·8d. per therm to 8·8d. per therm. It is pointed out that the standard price is subject to possible revision by the Board of Trade under section 1 of the Gas Regulation Act. This table may serve as a suggestion for other gas companies working on the therm basis.

Price of Gas per Therm.		Ordinary Stock. Maximum Rate of Dividend.	Redemption Fund (see footnote). Annual Amount.	Redemption Fund (see footnote). Approximate Rate.	Net Rate of Distributable Dividend.
	d.	Per Cent. £ s. d.	£	Per Cent. s. d.	Per Cent. £ s. d.
	15·8	3 12 0	*Nil*	*Nil*	3 12 0
	15·6	3 14 8	,,	,,	3 14 8
	15·4	3 17 4	,,	,,	3 17 4
Standard Price and Dividend.	15·2	4 0 0	,,	,,	4 0 0
	15·0	4 2 8	10,000	1 4	4 1 4
	14·8	4 5 4	10,000	1 4	4 4 0
	14·6	4 8 0	10,000	1 4	4 6 8
	14·4	4 10 8	20,000	2 8	4 8 0
	14·2	4 13 4	20,000	2 8	4 10 8
	14·0	4 16 0	20,000	2 8	4 13 4
	13·8	4 18 8	30,000	4 0	4 14 8
	13 6	5 1 4	30,000	4 0	4 17 4
	13·4	5 4 0	30,000	4 0	5 0 0
	13·2	5 6 8	40,000	5 4	5 1 4
	13·0	5 9 4	40,000	5 4	5 4 0
	12·8	5 12 0	40,000	5 4	5 6 8
	12·6	5 14 8	40,000	5 4	5 9 4
	12·4	5 17 4	40,000	5 4	5 12 0
	12·2	6 0 0	40,000	5 4	5 14 8
	12·0	6 2 8	40,000	5 4	5 17 4
	11·8	6 5 4	40,000	5 4	6 0 0
	11·6	6 8 0	40,000	5 4	6 2 8
	11·4	6 10 8	40,000	5 4	6 5 4
	11·2	6 13 4	40,000	5 4	6 8 0
	11·0	6 16 0	40,000	5 4	6 10 8
	10 8	6 18 8	40,000	5 4	6 13 4
	10·6	7 1 4	40,000	5 4	6 16 0
	10·4	7 4 0	40,000	5 4	6 18 8
	10·2	7 6 8	40,000	5 4	7 1 4
	10·0	7 9 4	40,000	5 4	7 4 0
	9·8	7 12 0	40,000	5 4	7 6 8
	9·6	7 14 8	40,000	5 4	7 9 4
	9·4	7 17 4	40,000	5 4	7 12 0
	9·2	8 0 0	40,000	5 4	7 14 8
	9·0	8 2 8	40,000	5 4	7 17 4
	8·8	8 5 4	40,000	5 4	8 0 0

Note.—After £1,000,000 of ordinary stock has been purchased by means of the redemption fund, and cancelled, the deduction for the redemption fund ceases.

Welsbach Mantle Prices.—The Welsbach Light Company, Ltd., announce that the prices of all their well-known standard brands of mantles have been reduced.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" regarding applications to the Board of Trade for Orders under the Gas Regulation Act.

Boston Gas Light and Coke Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 8d. per therm.

It is also proposed that an additional charge of 2·5d. per therm should be authorized in respect of gas supplied through a prepayment meter.

Hayfield Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 3d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 3d. per therm, and in respect of gas supplied through prepayment meters 1s. 4d., and through prepayment meters including gas-fittings 1s. 5d.

Sandwich Corporation.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. 6d. per 1000 c.ft. within the borough of Sandwich, with an addition of 1s. outside; and the price they have asked the Board of Trade to substitute for this is 15·2d. per therm, with an addition of 1·2d. outside the borough.

DECLARATION OF CALORIFIC POWER.

Ferndale Gas Company, Ltd.—450 B.Th.U. (Dec. 25.)

GAS REGULATION ACT ORDER.

The Director of Gas Administration has forwarded a copy of the following further Order made by the Board of Trade under section 1 of the Gas Regulation Act.

East Dereham Urban District Council.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 16d. per therm.

After the declared date, the price of 13·6d. per therm shall be substituted for the price of 4s. per 1000 c.ft. mentioned in paragraph (2) of Article XIII. of the East Dereham Gas Order, 1904, as confirmed by the Local Government Board's Provisional Orders Confirmation (Gas) Act, 1904.

After the declared date, the price of 16d. per therm shall be substituted for the price of 5s. per 1000 c.ft. mentioned in paragraph (3) of Article XIII. of the East Dereham Gas Order, 1904. (Oct. 11.)

INVERTED LIGHTING FOR EDUCATIONAL INSTITUTIONS.

The Education Committee reported to yesterday's meeting of the London County Council that they have had under consideration for some months past the question of the gas lighting of educational institutions, particularly of those elementary school buildings largely used in the evenings. A great number of complaints have been received as to the unsatisfactory lighting of the rooms used by evening institutes. At present the large majority of the schools are lighted by incandescent burners of the upright type, which are relatively inefficient and wasteful, and involve considerable labour and expense in maintenance. The Committee have had before them representations from the L.C.C. Schoolkeepers' Association on the question of the labour of maintenance of these burners. During the winter of 1920-21, they arranged with the two largest gas companies, as an experiment, to renovate and maintain the gas lights in 24 selected schools at cost price in order to obtain information as to the probable cost of handing-over to the gas companies the maintenance of the gas installations of all the educational institutions. The results of the experiments convinced them that it would be uneconomical to proceed further in this direction.

They have now had before them proposals for substituting for the upright burners, in the schools largely used in the evenings, modern super-heated inverted burners, adaptable to the existing fittings. From experiments conducted in selected schools, it appears that the cost of these inverted burners will be recovered by reductions in the gas consumed in from five to six years, after which time there will be a considerable permanent saving; also that the lighting will be improved, and the cost of maintenance reduced. The Committee are advised that the average cost of installing the inverted burners would be about £110 for each school. They have decided to proceed at once with the installation of modern inverted gas-burners in those schools largely used in the evenings where the lighting is most unsatisfactory, subject to the total expenditure for the current financial year not exceeding £5500. As soon as the consumption of gas in these schools for some of the winter months is known, they propose to consider a programme for dealing with the remaining schools over a period of two years.

Better Street Lighting at Oswestry.—The question of street lighting was discussed at a meeting of the Oswestry Town Council last week, when the Mayor moved the acceptance of the offer of the Gas Company to light and maintain 262 street-lamps for twelve months for £1000. Last year, he said, 161 lamps were lighted at an actual cost of £963 6s. In pre-war days 352 lamps were lighted, and the total cost to the town at that period was somewhere about £800. The Committee went thoroughly into the question, and thought the time had come when the Council should have the town lighted in a good and proper manner. The proposition was carried unanimously.

THE HALIFAX GAS CENTENARY.

The members of the Halifax Corporation last Thursday paid an official visit to the gas-works, to mark the occasion of the centenary of gas making in the town, and also the recent completion of extensive improvements to the plant, by Messrs. Drakes, Ltd. The inspection occupied the whole of an afternoon; the members taking a genuine interest in what was shown to them. Attention was drawn particularly, of course, to the recently-erected vertical retorts, and comparisons were made of the advantages of the system over other methods of gas production.

In the evening there was a happy gathering at high tea, at which the first toast after that of "The King" was distinctly of an unusual—but in this case most appropriate—nature. It was the toast of "The two oldest employees" (four representative employees at the gas-works were present as guests), and was proposed by Mr. W. COURT, himself an old employee at the gas-works and one of the old members of the Town Council. The employees toasted were Messrs. T. Helliwell and J. Butterworth; and Mr. Court spoke of the time when he himself had taken Mr. Helliwell in hand to show him his work, forty-seven years ago. Mr. Court said he was at the gas-works first in 1857, and began working there regularly in 1870—about the time of the beginning of the Franco-German war.

Mr. HELLIWELL, in responding, said there were only four living now who worked at the gas-works with him at first. He was proud of the fact that he had not lost five minutes of time during his long period of employment.

Mr. BUTTERWORTH, also responding, said he started as a lamplighter in 1878, and must have walked some 120,000 miles on his duties.

Alderman Dr. BRANSON, proposing the toast of "The Gas Committee," referred to the growth of the gas-making industry, a mixture of chemistry and commerce—one hardly knew which of the two was the most prevailing feature. He congratulated the Committee on their progressive policy, despite difficulties owing to the restricted area, entailing the superimposition of the structure. As a medical man, he urged the great value of gas in reducing the quantity of smoke in a town. It was not the biggest chimneys which did the most damage to public health, but the vast number of domestic fires.

Alderman J. H. WADDINGTON (the Chairman of the Gas Committee), replying, spoke of the utter inaccuracy of the belief of some people that gas was coming to the end of its latitude because of the development of electricity and other modern inventions. He had been associated with gas for a long time, and his view was that the outlook for gas was brighter and more hopeful than ever before. The Committee recognized the value of both gas and electricity, and had no antagonism to the latter. The Committee were not particularly anxious to retain gas as the only illuminant for buildings, though those who could not afford electricity would find gas a very good substitute. The increased use of electricity for power had had its effect on the demand for gas. In 1908, 62,830,000 c.ft. had been used by gas-engines, whereas the total annual consumption now was only 25,328,800 c.ft.; but the loss in business for power purposes was not reflected in the accounts, because the loss was made up by new business. The record output of gas was in 1917-18, since when there had been a decrease in the demand for industrial heating amounting to over 133,000,000 c.ft. per annum; but there had been a revival in the sale of gas for domestic and business purposes generally, with the result that the sale for the past year was equal to the business done in 1907-8, and was only 40,000,000 c.ft. short of the record established in 1917-18. The improvement in burners and appliances for cooking and heating had effected great economy in the quantity of gas required for a given amount of light or heat—an improvement equivalent, of course, to a reduction in the price of the gas. For some years the Gas Committee had been doing their utmost to bring all these appliances within the reach of every consumer, and during the past year more than 5000 of the latest gas lighting burners and over 3000 of the new boiling stoves had been fixed in houses in Halifax. Yet these fixings had been merely a sideline to the regular transactions at the showrooms, where the sale of appliances now averaged, roughly, £500 per month. Somebody had said the showrooms in Waterhouse Street were a costly burden. As a matter of fact, they provided a magnificent income, and they were a satisfactory solution for the widest possible sale of good fittings. At the works, reconstruction over six years had cost £120,000, of which more than £80,000 had been repaid out of revenue. When the balance was repaid, the Committee would be in a position to reduce the price of gas still further. The undertaking had cost about £700,000, about half of which amount had been paid off; and they had also contributed relief to local rates to the extent of £358,000. Had they paid off capital charges instead of relieving rates they could have been selling gas to-day at 1s. per 1000 c.ft. less than the present price; and this was a great trouble to the Committee. If the Corporation would realize all that it meant to an undertaking they would see that every concern ought to stand on its own bottom, and the income should be devoted to wiping out the cost of the undertaking and supplying the commodity at the cheapest possible price.

Mr. HERBERT TURNER, who also responded to the toast, spoke of the great future of gas coke for central heating, and referred to the good feeling between the Committee and their employees. He spoke of the great prospects of gas cooking and heating.

Mr. J. BURKE (the Chairman of the Watch Committee) dealt with the growth in public lighting, and the great help of the gas industry in that direction, but considered the future of gas lay more in cooking and heating than in lighting.

Mr. W. B. M'LUSKY, the Engineer and General Manager of the Gas Department, proposed "The Contractors," and said the fame of Drakes was not confined to their own town, or their own country, but was spread over the world. He suggested that the new installation was unequalled, combining as it did all the modern fittings with the best of old-fashioned heating method. A great gain in manufacture was that the gas would burn without accompanying odour.

Mr. J. WILFRED DRAKE, who was accompanied by Mr. T. Thompson, in replying, said jerry-building had been anathema to his grandfather, the founder of the firm, and it was still so to the present firm. They knew their reputation and the value of their plant, and they were out to maintain both. One thing he would impress on the Corporation of Halifax was the fact that the firm, like all big concerns, were in keen competition with undertakings in other areas; and the high rates of Halifax were a severe handicap in this competition.

Mr. F. SLATER next gave "The Town Council," which was responded to by Mr. A. W. LONGBOTTOM, the Mayor-elect, who said the heavy charges on the gas undertaking were bad finance and unfair and inequitable on the consumer. He believed that feeling was pretty general throughout the Council now, and he suggested that it was a matter which should be taken into serious consideration. He hoped the gas and electricity undertakings would work side by side in harmony. He assured Mr. Drake that the questions of high rates and the bad state of the roads of the borough generally were matters which were before the Council and their Committees; and they would do their best with the funds at disposal.

The final toast was that of "Our Workmen," proposed by Mr. S. GREGORY, and acknowledged by Messrs. F. HAIGH and T. GALLAGHER, both men of long service.

GLASGOW HOUSING AND HEALTH EXHIBITION.

Large crowds have been attracted to the Housing and Health Exhibition in the Kelvin Hall, where the Glasgow Corporation Gas Department have a very fine display of heating, lighting, and cooking appliances. The exhibit is perfectly arranged, and has aided to familiarize the visitors with the latest gas-fittings and equipment. A model household laundry is shown; and lady experts demonstrate and advise as to cooking by gas.

The Falkirk Iron Company, Ltd., have on view the "smooth-top" gas-cooker, and other appliances in which they specialize. Messrs. Burbeek and Co., of Stockton-on-Tees, call attention to portable gas cookers, heaters, ovens, and geysers. The Thermal Syndicate, Ltd., of Wallsend-on-Tyne, stage a complete range of "Vitreosil" heat-proof, anti-glare globes and mantle protectors, in a variety of colours and designs. Mr. Alexander J. Smith, of Glasgow, displays gas-cookers and fires, wash-boilers, burners, mantles, &c.; and the Lawson Manufacturing Company, of London, their portable gas-heater.

BOROUGH OF COLNE GAS DEPARTMENT.

Annual Report.

In his annual report to the Gas Committee, Mr. Fred. Thorpe, Engineer and Manager to the Borough of Colne Gas Department, says that the expenditure for the year ended March 31 was £59,780, and the income £68,095, leaving a gross profit of £8315. Interest and contributions to the sinking fund totalled £7472, so that the net profit was £843. This sum has been carried to the revenue appropriation account. The price of gas to ordinary consumers has been throughout the year 4s 6d. per 1000 c.ft., less a discount of 5 p.ct. The stoppage of the mines for the first three months of the financial year cost the department over £4000. During the whole time, however, the gas supply was kept up throughout the district, and the pressures were not largely altered. Unfortunately, the Tully plant was not ready for making gas until June, 1921; but for the last four weeks the plant assisted very materially in the production of gas, the fuel used being chiefly coke and oil.

During the twelve months, 13,052 tons of coal were carbonized; the make of gas per ton being 19,187 c.ft. The total quantity of gas manufactured was 250,473,000 c.ft., an increase of 21,109,000 c.ft., or 9·2 p.ct., on the previous year.

For some years past considerable difficulty has been experienced in giving consumers adequate pressure. The trunk mains from the works to the several centres of consumption would not carry the gas to the outlying districts; and a system of high-pressure boosting was ultimately decided upon. A compressor was installed at the works, and during last winter consumers received much assistance. The increased consumption during the past year is largely due to the improved pressure in the mains, enabling the consumers to get a better supply. Many of the smaller mains have been enlarged and services renewed during the twelve months.

The gross returns from residuals amounted to £11,686, a decrease of £5506 when compared with the year preceding. The number of consumers continues to increase, and there has during the period under review been an inclination on the part of some of the customers to give up the use of slot-meters and return to ordinary ones.

Mr. Thorpe suggests the advisability of reconstructing on modern carbonizing lines No. 1 retort-house, which has been manufacturing gas by the same method for the past thirty years.

Danish Gas Company.—The net revenue of the Company for the year ended June 30, after charging debenture and other interest, and placing £5556 to reserve and redemption account, was £19,025. The dividend on the ordinary shares is 2 p.ct.

Public Lighting of Quarry Bank.—It was reported to a meeting of the Quarry Bank Urban Council last week that the Brierley Hill Gas Company had now intimated that the cost of labour for the lighting, &c., of the number of lamps suggested by the Council would be the same as if the whole were lighted. Thus the cost would be £4 11s. each for single lights and £7 1s. for double lights, for the six months to March 31. Alderman Shaw remarked that prior to the war the lamps were costing £2 12s. 6d. for eight months, whereas the Council were now asked £4 11s. for six months, which charge he thought was out of all reason. The Council decided to adhere to their previous decision not to light the lamps; and the Surveyor was instructed to prepare a plan showing suitable proposals to enable a quotation to be obtained for the district to be lighted by electricity where cables exist or can be made available, and to make arrangements with a view to obtaining additional temporary lights.

SOCIETY OF CHEMICAL INDUSTRY.

Annual Dinner.

The Annual Dinner of the Society of Chemical Industry was held at the Connaught Rooms, Kingsway, W.C., last Friday—Dr. E. F. Armstrong, F.R.S., the President, in the chair.

Mr. Roscoe Brunner, proposing the toast of "The Society of Chemical Industry," said that it had done more to raise the status of the chemist than any other agency since its foundation. He could claim to have been connected with the chemical industry since 1874; and in those days, the elder members of the Society would remember, a chemist who had not been educated somewhere on the Continent was not considered worth his salt. But we have progressed very far since then. The scientific education of this country was certainly better than that in any other country in the world. He hoped that the Society would continue to press for the better standing of the chemist, and would take such steps as were possible to give the chemist that position in the world that he possessed in the opinion of those who were qualified to judge him.

Dr. H. S. Hele-Shaw (President of the Institution of Mechanical Engineers) supported the toast, and said that he felt quite at home in a gathering of chemists, because of the close relationship between the work of the chemist and the engineer. The objects of the Society of Chemical Industry and the Institution of Mechanical Engineers were identical in their respective industries. Engineers and chemists must co-operate, and it was this co-operation which formed the strongest bond of union between men. The Institution of Mechanical Engineers had just celebrated its 75th anniversary, and had a membership of 10,000. The Society of Chemical Industry was in its 40th year, and had a membership of about 6000—a figure which the Institution of Mechanical Engineers reached ten years ago. He hoped that in another ten years the Society would have a membership equal to that of the Institution of Mechanical Engineers.

The President, replying to the toast, said that there was something about the chemist which was hard to define. Chemists seemed to suffer from an excess of modesty, and if they were to reach that standard of excellency in the world, and to have that weight in the counsels of the nation, which they should have, and which they had earned, something must be done to put this state of things right. The only advice he could give them that evening was advice based on the words of the President of the Institution of Mechanical Engineers, and that was to keep on getting together.

INSTITUTE OF PAINT AND VARNISH TECHNOLOGISTS.

It was decided, at a dinner attended by members of the Oil and Colour Chemists' Association and the Paint and Varnish Society, last Wednesday, to take steps to form the Institute of Paint and Varnish Technologists. Attempts to secure greater co-operation in the paint and varnish and oil and colour industries have been made for some years, and the discussions which have taken place in this connection have now culminated in the decision to form the new body. The industry has been represented hitherto on the technical side by two bodies—the Paint and Varnish Society and the Oil and Colour Chemists' Association—which have been working independently. The idea of forming a group of the Society of Chemical Industry was abandoned in favour of a comprehensive Institute of Paint and Varnish Technologists, which should include within its membership not only the scientific and technical workers in the industry, but the manufacturers themselves. The scheme has now received the unanimous approval of both bodies, and a Provisional Committee, consisting practically of the two Councils, has been formed to draw up a definite scheme, which will involve the disappearance of the two existing bodies.

The industry represents many hundreds of firms, employing in the aggregate, about one million workers, and having a capital of several millions sterling. Many manufacturers have supported the scheme so far as it has gone, and it is upon them that the chief responsibility in the matter of finances will rest. Proposals have been made in this direction—one being that each firm should, at any rate for the first year, subscribe £10, and another that an annual subscription based on the capital of the particular manufacturers should be levied.

One of the activities of the new body will be the prosecution of organized research, quite apart from that which is conducted in private laboratories. The corrosion of iron and steel used for structural purposes costs this country many millions of pounds per annum, and the vast importance of investigating means of adequately protecting these structures does not need emphasis. Very great care is necessary in the production of high-quality iron and steel, and yet the life of this material, when used for structural purposes, is dependent upon the quality of the protective coating given to it. In this connection also, in addition to the protective qualities of the coatings used, investigation is needed of means of rendering those coatings permanent, or, at least, more permanent than some of them are at present. There are a great many other problems to which attention is to be directed.

Prepayment Meter Claim at Arundel.—In the local County Court, the Arundel Gas Company successfully claimed from Frederick Brassfield £9 9s. 7d., being £7 9s. 4d. for gas supplied, 11s. for meter hire, and £1 9s. 3d. for fittings. Mr. Edward J. Coe, Manager to the Gas Company, said that 18,400 c.ft. of gas had been used, and this, at 8s. 4d. per 1000 c.ft., should have brought in £7 13s. 4d.; whereas, when the collector went round at the end of the quarter, there was only 4s. in. The Company immediately put in a new meter. Defendant said it was simply the Gas Company's neglect. In three months the Company put two new meters at his house. They were told immediately the meters went wrong, and it was their duty to put them right. Judgment was given for plaintiffs for the full amount, to be paid at the rate of 10s. monthly.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Oct.* 16.

Pitch continues the chief item of interest in the London tar products market. The demand remains strong, and the price to-day is certainly not below 100s. per ton f.o.b. makers' works. Creosote is also a firm market at from 6⅜d. to 7d. per gallon in bulk *ex* works. The bulk of the orders for road tar have now been filled, although there is still a certain amount being delivered. The price has advanced, in sympathy with pitch and creosote, to 7d. per gallon at makers' works. Solvent naphtha is quiet: the price for 95/160 quality being about 2s. 2d. per gallon. Pure benzole and pure toluole are quiet at about 2s. 6d. per gallon. Other products remain without change.

Tar Products in the Provinces.

Oct. 16.

The average values for gas-works products during last week were: Gas-works coal tar, 54s. to 59s. Pitch, East Coast, 95s. to 97s. 6d. f.o.b. West Coast—Manchester, 90s. to 92s. 6d.; Liverpool, 91s. to 94s.; Clyde, 93s. to 95s. Benzole 90 p.ct. North, 1s. 10d. to 1s. 11d.; crude 65 p.ct. at 120° C., 1s. 1½d. to 1s. 3d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 10d. to 1s. 11d. Toluole, naked, North, 2s. to 2s. 3d. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 2s. to 2s. 1d. Creosote, in bulk, North, liquid, 6½d. to 6⅝d.; salty, 5⅝d. to 5⅝d. Scotland, 4⅝d. to 5d. Heavy oils, in bulk, North, 6½d. to 6½d. Carbolic acid, 60 p.ct., 2s. to 2s. 1d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

There is very little fresh to report in tar products. The demand for pitch still continues; while the quantities likely to be available during the remainder of this year are not very great. Consequently, prices are being well maintained at 95s. to 97s. 6d. per ton f.o.b., and shrewd operators are looking for an advance to over £5 per ton. Benzole still remains without alteration, despite the fall in petrol prices which is now in operation. Solvent naphtha is experiencing a much better demand owing to improvement in the rubber manufacturing industry. Heavy naphtha and naphthalenes are without change. There is nothing fresh to report in cresylic acid; but carbolic acid is decidedly better, and makes 2s. 1d. per gallon for crude 60's and 7d. per lb. for crystals. Creosote is still affected by American tariff, and is slightly lower at 6d. per gallon. Intermediate products continue to show a firm front with many inquiries on export account, although without any material alteration in prices.

Sulphate of Ammonia.

There is no change in this material, and prices are fixed until the end of the year at £16 13s. per ton for neutral 25¾ p.ct. ammonia. Indications are that the scarcity will continue into next year, and further increases in price are therefore likely.

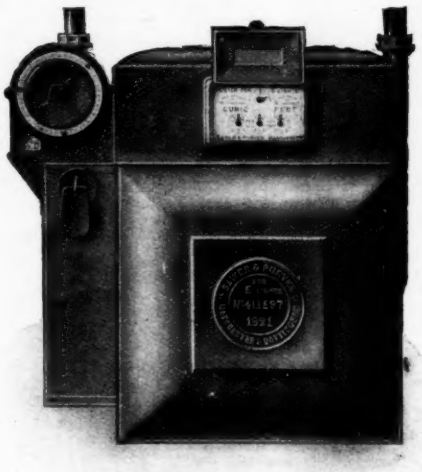
Cheap Gas in Scotland.—As from Oct. 30, the price of gas will be reduced by the Bothwell and Uddingston Gas Department (County of Lanark Middle Ward District) to 2s. 6d. per 1000 c.ft., which, it is said, will make it the cheapest gas in Scotland.

Zeimar Gas-Mantles.—The Ramie Company, of Bredbury, announce a reduction in the prices of "Zeimar" gas-mantles. This is the outcome of the tax imposed on German mantles, as the greater demand for the home-made product will result in lower manufacturing costs.

Price of Gas at Middlesbrough.—Alderman J. Calvert (the Chairman of the Middlesbrough Gas Committee) announced to the Corporation last week that, if the conditions at the gas-works continued as satisfactory as at present, he hoped that at the November meeting of the Committee they would be able to pass a resolution that a further reduction should be made in the price of gas. The figure at present is 3s. 10d. per 1000 c.ft., with 10d. discount.

Breakdown at the Howden Gas-Works.—A breakdown at the local Gas Company's works, which was reported to the Council last week, threatens to leave the district of Howden (East Yorkshire) short of gas for six or seven weeks, though it was stated that it might be possible to provide light for a few street-lamps on Sunday evenings. The Council have accepted the situation, on receipt of an explanation from the Company, and have appointed a Sub-Committee to decide exactly which of the street-lamps should be so lighted.

First Gas Lighting at St. Paul's Cathedral.—The following extract from "The Times" of Oct. 15, 1822, appeared in our contemporary last Saturday: It is not generally known that St. Paul's Cathedral will, through the whole of the ensuing winter, be brilliantly illuminated with gas light whenever it shall be necessary during divine service. The candlesticks and chandeliers, by the help of which it has been hitherto partially lighted up, have been suffered to remain in case of accidents, but no use is otherwise intended to be made of them. The pipes have been some time since laid down, and traversing the crypt, ascend into the choir and body of the church, where they are concealed by passing through the centre of eight elegant pillars of gilt brass, the summits of which are each furnished with three large burners. Four more pillars of a similar description, but of greater magnitude, adorn the railing in front of the altar, and by the brilliancy of the light they will afford supersede the necessity of continuing the pair of tall wax tapers which hitherto have stood upon the altar.



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TRADE NOTES.

Hulett's Gas-Fittings.

In Catalogue No. 166, just issued by Messrs. D. Hulett and Co., Ltd., of Nos. 57 and 58, Chancery Lane, London, W.C., are to be found particulars of gas-fittings of all sorts, as well as of many other articles essential to the distribution department of a gas undertaking. Burners, mantles, glassware, and shades are illustrated in many forms; and these are followed by small brass and iron fittings, &c. Then there are brackets and pendants for upright and inverted burners, and inside and outside lamps. Hulett's dry meters and patent wall supports for meters, boiling rings, or grillers occupy a page, as also do the firm's service cleansers and syphon pumps. They quote for pressure gauges, torches, blow lamps, and various gas-fitters' tools. Messrs. Hulett and Co. supply cookers and boiling rings; and particulars are given of various patterns of "Omega" and "Phiro" gas-heaters.

Barnard's Patent Grab.

Messrs. Wm. Goodacre and Sons, Ltd., of Russell Road, Victoria Docks, London, E., the sole manufacturers of Barnard's patent grabs, have forwarded a set of the latest literature which they have prepared for the use of those who, like gas managers, are faced with the necessity of handling material in bulk. These self-acting grabs are made in styles to suit varying circumstances and different materials, and are well fitted to undertake economical and expeditious handling. The design has been simplified, and the number of working parts reduced, as far as possible, and the grab can be used on a crane fitted with either a rope or chain, or it can be supplied in a form which may be alternatively fitted up for use with either rope or chain. An important point is that, while of robust design, the grab is light for a given capacity. It is stated that a Barnard self-acting grab having a capacity of 1 ton of coal weighs about 1 ton, thus rendering it possible for a grab to be installed on an old type of crane, where the margin of power is small. Mr. G. F. Zimmer, Assoc.M.Inst.C.E., a well-known authority on the subject of bulk handling of material, says the Barnard automatic grab is a machine which is absolutely safe to operate under all conditions, and is especially appropriate upon reaching the bottom of a hold where there is not sufficient coal to fill it at one operation. It can be lifted slightly, and thereafter transferred to quite another part of the hold, where there may be a further supply of coal, and opened by resting, so that a full grab is ensured. Therefore the grab need never be hoisted to its destination without a full load.

Withnell Price Reduction.—The Withnell Urban District Council have decided to reduce the price of gas from 6s. to 5s. 9d. per 1000 c.ft.

Cheap Gas at Barry.—The Barry Urban District Council have decided that the price of gas shall be reduced from 4s. 2½d. to 3s. 6¾d. per 1000 c.ft. This, it is stated, makes the price of gas there lower than in any other part of South Wales. The gas-works made a net profit of £17,000 for the year ended March 31 last.

A Good Position at Accrington.—At a meeting of the Accrington and District Gas Board last Thursday, the Chairman (Alderman Dewhurst) reported that the gas-works at Great Harwood were giving every satisfaction, and with the reduction of wages, cost of coal, and other things, he thought by the end of March they would be able to give a favourable report for the year. Mr. A. J. Harrison (the General Manager) had reported that the department for the sale of gas cookers and other appliances had never done so much business. He thought by the end of the year they would be able to give a fairly good reduction all round. For the five weeks ended Aug. 30 the Board's wages bill totalled £3324, against £5699 last year.

The Aberystwyth Town Council have decided to convert all the street-lamps from gas to electricity.

Swansea's streets are now lit throughout the night; the Corporation's economy measure having ceased last week.

An official denial is given to a statement that an old disused holder at Wheelton has been converted into a dwelling-house. There is an old holder in the district; but it is the property of the Calico Printers' Association, and is used for sorting rags.

The F. S. Pearson Engineering Corporation, of Fisk Building, 57th Street and Broadway, New York City, have re-established their department for Industrial Management and Technical Auditing of industries and Public Utilities. This department will be carried on together with their usual work of financing, developing, design, and construction of engineering projects and industrial plants.

The Birmingham Board of Guardians report that they have given careful consideration to the lighting system of Monyhull Colony (epileptics), where a large number of flat-flame burners are in use. These are described as wasteful, and a source of danger to the colonists. In addition, constant replacements of breakages of chimneys and globes are costly. The Medical Superintendent has been authorized to do away with all flat-flame burners, to reduce the number of burners where possible, and, where this is not practicable, to substitute inverted incandescent burners with wire-gauze globes or "Vitreosil" unbreakable glass globes or chimneys.

Messrs. A. & W. Richards have received instructions from the Directors to offer for sale by tender £1745 of 6½ p.ct. redeemable preference stock (or such amount as will, including premiums, realize this sum) in the Hatfield Gas Company, Ltd. The minimum price of issue is par, and the stock is to be redeemed at par on Oct. 1, 1932. The business of the Company shows a steady increase, and an agreement has lately been entered into with the Welwyn Gas Company, Ltd., to supply jointly the Welwyn Garden City, which is rapidly developing. It is anticipated that this extension will result in a considerable consumption of gas. The capital now being offered is required for the Welwyn extension of the Company's business. Tenders must be sent in to Messrs. Richards, at No. 37, Walbrook, E.C., not later than 11 o'clock to-morrow (Thursday).

STOCK MARKET REPORT.

The Stock Exchange has had a happier week. It opened quietly and cautiously; but the tone soon declared itself favourable, and leading markets displayed strength. Business was more active on Tuesday, and prices were still rising, and the next two days were cheered by the good news from Mudania. Friday was not so buoyant—sales to secure profits being rather active; but closing prices were still well in advance of the opening figures. The gilt-edged category did well, Home Government issues conspicuously, Friday's figures for the big four being: Consols 57½-57$\frac{13}{16}$, War Loan 100⅜-100¾, Funding 84⅞-85⅜, Victory 88 88½. Indian and Colonial issues rose. Home Rails did well up to a point, and Canadian and Argentine were firm.

The Foreign Market rose after a poor start; French, Russian, and Turkish being prominent. Rubber had a rally.

Business in the Gas Market was very quiet—the lightest week of this autumn so far—and Gas Light and Coke furnished one half of it. Most of the other companies were overlooked altogether. Many variations in quotation could not be expected; but the tone was distinctly strong, and all but one or two were upward. The London Companies were firm, and Gas Light ordinary rose 2. In Suburban and Provincial, Alliance and Dublin rose 2, the three Sheffields 1 each, Tottenham "A" and Wandsworth "C" 2 each. Newcastle fell 1. Imperial Continental was firmer, and recovered 1.

The following transactions in gas during the week were recorded: On Monday, Alliance and Dublin 64½, 64⅞, European 10, Gas Light ordinary 94⅜, 95, 95⅛, 95¼, 95⅜, 95½, 95¾, 96, 96¼, 96⅜, ditto maximum 62½, 62⅝, ditto debenture 62, Imperial Continental 157, Newcastle 3½ p.ct. debenture 67¼, South Metropolitan 94⅛, 94⅜, Tottenham "B" 99, Folkestone 63½, 64, Leatherhead 5 p.ct. 7⅛. On Tuesday, Gas Light ordinary 95⅛, 95⅜, 96, 96¼, 96⅜, ditto maximum 62⅜, ditto preference 78, ditto debenture 61½, 62⅝, Imperial Continental 158½, Primitiva preference 33s. 6d., ditto 4 p.ct. 1911 debenture 55½, South Metropolitan 94⅛, 94½, 94⅝, ditto 6½ p.ct. debenture 105½, South Suburban 98⅛, Tottenham "B" 100, Croydon 7 p.ct. debenture 102, Liverpool 7 p.ct. preference 105. On Wednesday, Aldersbot 4 p.ct. preference 69⅞, 70, Alliance and Dublin 64½, 65, Brentford "A" 102⅞, ditto "B" 102, 102⅜, 102½, 102⅜, 102⅞, European 10$\frac{7}{16}$, 10⅝, Gas Light ordinary 96, 96¼, 96⅜, 96⅜, 97, ditto maximum 62⅜, ditto preference, 76½, ditto debenture 61, Imperial Continental 158, 158½, 160, Plymouth and Stonehouse 99, South Metropolitan 94½, South Suburban 97, Liverpool 7 p.ct. preference 103. On Thursday, Brentford "A" 102⅜, 103¼, Croydon maximum dividend 80, European 10⅜, Gas Light ordinary 96, 96⅛, 96⅜, 96½, 96⅝, 96⅞, 96⅝, 96⅞, 97, 97¼, 97½, ditto maximum 63, ditto preference 77½ Newcastle 75. Plymouth and Stonehouse 99½, South Metropolitan 94, 94½, 94⅜, Tottenham "A" 115, ditto "B" 98½. Barnet 4 p.ct. debenture 74½, 75, Hornsey 4 p.ct. debenture 74, 74½, Liverpool 7 p.ct. preference 105, Colonial Association 14s. 6d., 14s. 9d. On Friday, Alliance and Dublin 64, 65½, Bournemouth 6 p.ct. preference 8⅞, 9, Continental Union 29, ditto 7 p.ct. preference 51, 52½, European 10½, 11, Gas Light ordinary 96⅜, 97, 97⅛, 97¼, 97⅜, 97½, 97⅝, ditto preference 78, Primitiva 12s., ditto preference 33s. 6d., 33s. 9d., 34s., South Metropolitan 93⅜, 94, 94¼, Tottenham "B" 100½, Wandsworth Wimbledon 100, Brighton and Hove 5 p.ct. debenture 90, Croydon 7 p.ct. debenture 105, Southend 5 p.ct. new ordinary 81.

In the Money Market, the position fluctuated considerably, almost from day to day in quick succession. In mid-week there was a fairly strong demand, but by the close things were quite comfortable. Discount rates were steady almost up to the close, when they became easier. Silver was very weak, being subjected to continuous selling, and the price finally was down to 34⅜d. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Transactions.
£			p.c.					
182,049	Stk.	Aug. 24	4	4%	Aldershot 4 p.c. Pref. .	..	68—73	69⅞—70
1,551,868	,,	Oct. 5	2½	5%	Alliance & Dublin Ord.	59—64	62—67*	64½—65½
374,000	,,	July 13	4	4%	Do. 4 p.c. Deb.	76—79	60—65	...
280,000	5	May 18	7½	4/—	Bombay, Ltd. . . .	5⅛—6⅛	4¾—5¼	...
100,000	5	Aug. 10	16	7½%		..	11—12	...
383,110	10	,,	7	7%	Bournemouth Gas and Water { B 7 p.c. .	15—15½	10½—11½	...
115,000	10	,,	6	6%	Pref. 6 p.c.	13⅜—14	8—9	8⅞—9
162,065	—	June 29	—	4%	4 p.c. Deb.	..	73—78	...
992,045	Stk.	July 27	14	6t/-	Brentford A Consolid. .	261—266	98—103	102⅜—103⅛
734,920	,,	,,	11	6t/3	Do. B New . . .	204—209	98—103	102—102⅜
55,000	,,	,,	5	5%	Do. 5 p.c. Pref. .	109—111	82—87	...
221,400	,,	June 15	4	4%	Do. 4 p.c. Deb. .	91—93	75—80	...
214,775	,,	Aug. 24	11	11%	Brighton & Hove Orig. .	208—213	165—170	...
244,200	,,	,,	8	8½%	Do. A Ord. Stk.	154—159	120—125	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max. . .	..	..	...
530,000	20	Oct. 5	12½	22/6	British	44—45	30—32*	...
120,000	Stk.	June 29	4	4%	Do. 4 p.c. Deb. Stk.	88—90	75—80	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—58	...
100,000	10	June 1	—	7%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	Apl. 27	—	4½%	Do. 4½ p.c. Pref.	4—6	6¼—7¼	...
100,000	Stk.	June 29	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	73—78	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord. . .	108—110	..	...
1,513,280	,,	July 27	5/0/4	56/-	Commercial 4 p.c. Stk.	106—108	93—98	95
560,000	,,	,,	5½	55/-	Do. 3½ p.c. do.	103—105	93—98	...
475,000	,,	June 15	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	55—60	...
800,000	,,	Dec. 15	4	—	Continental Union, Ltd.	76—79	2)—34	29
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	30—35	51—52½
660,000		Sept 1	—	6%	Croydon sliding scale. .	..	84—89	
284,975		,,	—	5%	Do max div. . .	..	78—82	80
492,270	Stk.	—	6	4½%	Derby Con. Stk. . .	123—125	..	...
55,000	,,	—	4	4%	Do. Deb. Stk. . .	102—104	..	...
1,002,180	10	July 13	10	5/0	European, Ltd. . . .	17½—18	10½—11½	10—11
16,298,975	Stk.	July 27	4/17/4	52/-	Gas { 4 p.c. Ord . . .	98—102	90—98	94⅜—97½
2,600,000	,,	,,	3½	35/-	Light { 3½ p.c. max. . .	76—79	61—64	62½—63
4,062,235	,,	,,	4	4%	and { 4 p.c. Con. Pref.	96—99	76—81	76½—78
4,674,850	,,	June 15	3	3%	Coke { 3 p.c. Con. Deb.	72½—74½	61—64	61—62⅜
130,000	,,	Dec. 11	10	10%	10 p.c. Bonds .	..	..	...
82,500	,,	Sept. 21	5	65/7½	Hastings & St. L. 5 p.c.	..	95—100	...
258,740	,,	,,	3½	50/7½	Do. 3½ p.c.	87—89	75—78	...
70,000	10	May 18	11	7½%	Hongkong & China, Ltd.	16½—16¾	6—7	...
86,600	Stk.	Aug. 24	9	9½%	Hornsey 7 p.c. . . .	..	127—132	...
1,976,000	,,	May 18	9	10%	Imperial Continental .	150—160	156—161	157—160
404,800	,,	Aug. 10	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	70—75	...
235,242	,,	July 27	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	95—100	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A.	211—213	..	...
						B. 146—148	..	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	...
165,736	,,	Aug. 10	7/5/6	87/3	Maidstone 5 p.c. . .	..	87—92	...
63,480	,,	June 29	—	3%	Do. 3 p.c. Deb . .	..	54—59	...
75,000	5	,,	6	6%	Malta & Mediterranean Met. of Melbourne { 4½ p.c. Deb.	4⅛—4⅜	3¼—3⅜	...
250,000	100	Oct. 2	4½	4½%		99—101	8)—96*	...
541,920	Stk.	June 1	4	4%	Monte Video, Ltd. . .	11½—12	62—67	...
1,875,892	,,	July 27	4½	4½%	Newcastle & Gatsh'dCon.	98½—99½	74—76	75
529,705	,,	June 29	3½	3½%	Do. 3½ p.c. Deb.	82—83	67—68	6 ½
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	..	12½—13	...
55,940	10	Aug. 24	7/14/0	7/8⅜	,, ,, 7 p.c.	14—15	10½—11½	...
300,000	Stk.	May 18	8	8%	Oriental, Ltd. . . .	117—122	92—97	...
60,000	5	—	10	—	Ottoman, Ltd. . . .	7½—7⅝	2—3	...
188,120	Stk.	June 29	—	6/3/9%	Plym'th & Stonh'se 5 p.c.	..	93—98	99—99½
60,000	50	Aug. 24	13	65/-	Portsea Island, B .	128—131	100—105	...
100,000	50	,,	12	60/-	Do. C . .	118—121	85—90	...
249,980	5	—	8	—	Primitiva Ord. . . .	5⅛—6	$\frac{15}{16}$—$\frac{31}{32}$	12/6
499,960	5	—	5	—	Do. 5 p.c. Pre. .	4½—5	1⅛—1⅛	33/6—34/-
521,600	100	June 1	4	4%	Do. 4 p.c. Deb. .	91—93	68—73	...
600,000	Stk.	July 27	4	4%	Do. ,, ,, 1911	..	55—60	55½
346,198	,,	June 29	4	4%	River Plate 4 p.c. Deb.	85—87	53—58	...
150,000	10	Sept. 21	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5½—6	...
125,000	50	July 3	5	5%	5 p.c. Deb.	47—49	35—38	...
135,000	Stk.	Aug. 24	10	5%	Sheffield A	223—224	96—98	...
209,984	,,	,,	10	5%	Do. B	222—224	96—98	...
523,500	,,	,,	10	5%	Do. C	220—222	96—98	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c. . .	..	..	...
90,000	10	June 29	9	7½%	South African . . .	10½—11½	7—9	...
6,609,895	Stk.	July 27	5/4/0	5%	South Met. Ord. . . .	111—113	93—96	93¾—94¾
250,000	,,	July 13	—	5%	Do. Red. Pref. .	..	94—96	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb. .	72½—74½	61—64	...
224,820	,,	Aug. 24	8½	8½%	South Shields Con. Stk.	157—159	106—108	...
1,087,795	,,	,,	6	6%	S'th Suburb'n Ord. 5 p.c.	114—116	97—100	97—98½
368,837	,,	June 15	5	5%	Do. 5 p.c. Deb. Stk.	116—118	95—100	...
647,740	,,	May 18	5	5%	Southampton Ord. . .	99—102	75—80	...
121,275	,,	June 29	4	4%	Do. 4 p.c. Deb. Stk.	..	63—68	...
120,000	,,	July 27	—	7½%	Tottenham { A 5 p.c. .	135—138	112—117	115
782,275	,,	,,	6	6%	District { B 3½ p.c. .	115—117	97—102	98½—100½
181,255	,,	June 15	4	4%	4 p.c. Deb.	87—89	75—80	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	¼—½	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	20—30	...
236,476	Stk.	Aug. 24	5	2½%	Tynemouth 5 p.c. max.	108½—109	73—75	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 27	8½	72/6	Wandsworth A 5 p.c. .	151—156	111—115	...
855,636	,,	,,	6½	57/6	Do. B 3½ p.c. .	129—134	95—100	...
108,075	,,	,,	—	50/9	Do. C. . . .	..	87—92	...
140,865	,,	,,	—	50/9	New Ordinary . . .	..	87—92	...
352,000	,,	,,	6½	53/9	Wimbledon 5 p.c. . .	117—122	95—100	100
98,000	,,	,,	6½	58/9	Epsom 5 p.c. . . .	121—126	95—100	...
88,416	,,	June 29	3	3%	3 p.c Deb. Stk. . .	66—69	57—60	...

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